DNA Profiling as a Scientific Method of Investigation in India: A Socio-Legal Study

SUMMARY OF THESIS

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SUMMARY

1.1 INTRODUCTION

Since ancient times, crime exists in one or another form where there is human society. With the pace of time and technological advancement of society, the methods and techniques adopted in committing a crime have undergone an extraordinary change. It renders the traditional interrogative method incapable to check the criminal and requires more advanced and scientific methods to detect crime and criminal investigation. Forensic science specifically the technology of DNA profiling fulfills this gap required in the criminal justice administration of countries around the world. The evidence of forensic DNA profiling is being used in the court of law to solve complex criminal and civil cases like maternity disputes, child stealing, sexual offences, kidnapping, rape-murder, and immigration so on.

The role of Scientifics technologies in Criminal Investigation and law enforcement in modern criminal justice administration is very crucial. The police forces use many technical criminal investigation tools to detect real offenders and criminals. The purpose of the law is to ensure the protection of the innocent and to prevent the acquittal of the guilty, in doing so the law serves as a tool. When the legal system works in collaboration with science and technology, for the identification of criminals and penalizing the accused involved in the commission of a crime, the law becomes a powerful criminal justice mechanism to ensure public safety and order in society

It's important to remember that the purpose of a criminal trial isn't to sow fear among the public, but rather to provide swift justice. Looking at the condition of crime and convicted individuals in India has become more essential as numerous studies suggest that the conviction rate is decreasing and crime is growing day by day. People's dread and mistrust of the criminal justice system were stoked by the status quo. Because both conditions lead to unfairness, the inquiry agency cannot completely control the use of scientific methods. After studying every aspect of criminal justice administration and DNA technology and its compatibility in India advice may be made for better implementation and applicability. Even though several committees have been set up and recommendations have been made, implementation

is still inadequate in India due to the government's unwillingness to address the pressing issue of criminal justice policy.

1.2. FORENSIC DNA PROFILING "MEANING OF DNA"

The term DNA stands for Deoxyribose Nucleic Acid. It's found in each cell of the human body in the form of unique features and structures. It would be right to say that DNA is the blueprint of the human body in other words DNA is the Genetic-Bare-Code of the physical body of every individual.[1] DNA covers the genetic information or genetic code that works or that genetic information is required to identify any person or individual. DNA defines hereditary characteristics of individuals that play the role of finding the differences in the DNA structure of the individual. It's only difficult to identify identical twins through DNA profiling, and except the identical twins, every person can be identified by the analysis of his DNA profiling under forensic science. DNA is a concept relating to the hereditary study, that carries the characteristics of parents to children, be it physical or psychological.

According to the Black's Law Dictionary:

> "DNA identification is a method of comparing a person's DNA, a patterned chemical structure of genetic information, with DNA in a biological specimen to determine whether the person is the source of the specimen or not."[2]

Alan G Atherly, a professor of Genetics well-defined genetics as:

> "Science of Genetics devoted to the study of the underlying basis of heredity and variation. The term heredity indicates 'like begets like' that offspring generally resemble their parents. It is observable that certain diseases are prone to run within the family circle. The prime function of the science of genetics is to study how information is secreted in genes and how genetic traits are being transferred to their successors."[3]

The study of genetics was initially done by eminent Biologist Charles Darwin. He was the first to discover the consequence of genetic variations. Darwin was of the belief that inheritance is the transfer of mixed characteristics of mother and father to

[1] Subhash Chandra Singh, "DNA Profiling and the Forensic Use of DNA profiling in Criminal Proceedings" *53 Journal of Indian Law Institute* (2011). *available at:* https://www.jstor.org/stable/43953503 (Last visited on 11th April 2020).
[2] Black's Law Dictionary, *available at*: https://thelawdictionary.org/ (Last visited on April 19, 2020).
[3] H. Pearson, "Genetics: What is Gene?" *Nature* (2006)

the successive generation and it is transferred or carried out through the blood from parents to children. But Darwin failed to prove the theory behind the science of inheritance. Despite the failure of Darwin, his theory got much popularity amongst the scientific community in the 20th Century. The study of genetics can be divided into three categories that are Phenotype, Genotype, and DNA; the hereditary characteristics are called Genotype:

> "Genotype is "internal coded inheritable information" that is transported by living organisms. This information is stored within almost all cells and tissues (the internal body part) and is written in coded language, it is transferred from one generation to another as it is inheritable."[4]

Trying to investigate and try criminal proceedings is a difficult effort for law enforcement and the judiciary alike. It is not as straightforward as it seems at first glance to properly identify the accused in criminal trials. Investigation of criminals has undergone a sea change with the development of DNA analysis. It is more reliable than other scientific procedures. Forensic evidence does have an incredible capacity to make the court convict or release the accused in paternity issues and homicide cases. The primary goal of DNA profiling is to track down the source of genetic evidence acquired at the wrongdoing scene.[5] DNA-based information has become an increasingly important factor for the criminal justice system. A person's DNA is the most reliable of all biotechnological pieces of evidence in determining their identity. As a consequence, DNA profiling evidence may provide the following results:

- INCLUSION; Inclusion occurs when a DNA sample taken from a crime scene matches a known individual's DNA profile, whether the sample is from the victim or the suspect.
- EXCLUSION; A person's DNA analysis does not match with the biological DNA sample that was found at the crime scene. Where it was not certain of whose DNA either the victim or the criminal. In such a situation the suspects are excluded from the suspect's list.

[4] J.K Mason and Mc Call Smith, *Medico-Legal Encyclopedia* 16 (Butterworth London, 1995).
[5] *Supra Note 1, at p.1.*

- INCONCLUSIVE; where there is unsatisfactory evidence to either include or eliminate a person as a source of biological material taken as a DNA sample from the crime scene, it is inconclusive.

1.3. HISTORICAL EVOLUTION

It is a commonly seen phenomenon that the physical appearance of parents and their offspring uses to have resemblance or there exist similarities among them. This is because of children's genetic relation or genetic dependence on their antecedents. Forensic DNA technology was developed by Alec Jaffrey. DNA was thought to have been discovered in the 1950s by English physicist Francis Crick and American biologist James Watson. According to historical records, DNA was discovered by Swiss chemist Friedrich Miescher in the late 1860s.[6] Phoebus Levane and Ervin Chargaff, among others, contributed to its development. These researchers revealed new information about the DNA molecule, such as its primary chemical component and the way it interacts with other components. **Watson and Crick** could not have found out that the DNA molecule exists in a three-dimensional double helix structure if they didn't work together.

In the year 1866, the father of genetics, **Gregor Mendel,** asserted that human traits are passed down through the generations.[7] DNA was discovered by Russian researcher **Friedrich Miescher** in the year 1869.[8] The history of DNA evidence is not as old as of DNA. DNA Profiling was first ever used as evidence to identify criminals in the year 1986 in the United Kingdoms in the case of **R v. Pitchfork**[9]were in the case involved the rape and murder of two teenage girls. The court followed the principle of exchange propounded by **Dr Edmond Locard**[10], which implies that the offender must bring something to the crime scene and leave with something at the place of the crime and both things can be utilized as forensic evidence against the

[6] Pray, L., "Discovery of DNA Structure and Function: Watson and Crick" 1(1) *Nature Education* (2008) *available at*: https://www.nature.com/scitable/topicpage/discovery-of-dna-structure-and-function-watson-397(Last Last visited on 28th June 28, 2021).
[7] David Oldroyd "Gregor Mendel: The Founding Father of Modern Genetics" 8 *Endeavor* (1984). *available at:* https://www.sciencedirect.com/science/article/abs/pii/0160932784901261(Last Last visited on 2nd July 2021).
[8] Ralf Dahm, "Friedrich Miescher and the Discovery of DNA"278*Developmental Biology* (2005) *available at:* http://www.elsevier.com/locate/ydbio (Last visited on 22nd February 2021).
[9] (2009) EWCA Crim 963.
[10] Edmond Locard – The Forensics Library, *available at:* aboutforensics.co.uk (Last visited on18th Dec.2020).

perpetrator, in other words, it is known as that "every contact will leave a trace"[11] Forensic examination of the DNA of semen found in vaginal swabs from both deceased girls lead to the conclusion that both the girls were killed by the same person. This had been possible because of the pioneering work in the field of Forensic Science done by **Sir Alec Jaffrey**. This technology was not available to Indians because the invented DNA technique was gotten parent by Alec Jaffrey thus further experiments, examination and development of the DNA identification technique were prohibited. The examination invented by Alec Jaffrey was not allowed for other further experimentations. In India, the pioneering work of Dr Lalji Singh has a great contribution to the development of DNA technology. Dr Lalji Singh developed a procedure called the "**Banded Kraita method**" hereinafter referred to as the BKM probe. Dr Lalji Singh was the director of CFSL Hyderabad.[12] He had been a PhD research Scholar at BHU. His research was on the sex determination of sneak s. He discovered that female snakes have XX and male snakes have XY chromosomes. Dr Singh's BKM probe was capable to apply Forensic identification of the individual in criminal investigations which is tested and dependable, in fact with greater accuracy and authenticity than Alec Jaffrey's DNA probe.[13] Dr Lalji Singh successfully claimed that his BKM identification technology would be successfully applied in India for the forensic investigation of individuals.[14]

The forensic DNA technique is a rapidly growing technique strengthening the investigative accuracy and power of the criminal justice system. For the best use of DNA technology, American judges promulgated the Frye test and Daubert standard to incorporate the DNA technology in their justice administration with a strong agency called the FBI to function as guardian of the technical standard in DNA Profiling.

Forensic DNA technology is described by Swedish anthropologists Corinna Cruse from a different angle to different stakeholders of Criminal Investigation.

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[11] William E. Kirwan "Crime Investigation: Physical Evidence and the Police Laboratory" 181 *Journal of Inter Science* (1953) *available at:* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4102308/pdf/nihms593299.pdf (Last Last visited on 21st September 2020).

[12] Dr Lalji Singh, *My Travails in the Witness Box* 67(I.K International Publishing House, New Delhi 2012).

[13] Dr Lalji Singh, "DNA Profiling and its Applications" 60 *Current Science* (1991). *available at*: http://www.jstor.org/stable/24099013. (Last visited on 7th February 2021).

[14] M.C case no 17 0f 1988.

> "To a crime scene technician, forensic evidence is something that can be produced by traces from a crime scene. To a police investigator, forensic evidence is something that may be able to help him or her to assess a person's narrative. To a forensic scientist, forensic evidence is a trace that is to be analyzed and evaluated. To a prosecutor, forensic evidence will help him or she convinces the court of a defendant's culpability. And to a judge, forensic evidence is something reliable, an anchoring point in their assessment of a case."[15]

1.4. DNA FINGERPRINTING

The techniques of Molecular biology such as DNA fingerprinting and genetic fingerprinting may be used to identify people based on their genetic composition. The geneticist from the United Kingdom, Sir Alec Jeffreys created it in 1984, while Dr. Jeffrey Glassberg established it in 1983. Jeffreys used the RFLP study of mini satellite DNA as the basis for his novel research. DNA fingerprinting relies heavily on methods such as RFLP analysis. Somewhere between 25 and 500 base pairs of DNAS are required for the RFLP examination. Restrictive enzymes are also used in traditional DNA fingerprinting to cleave DNA into little fragments. Then, using "gel electrophoresis", the DNA fragments may be isolated and immobilized on a membrane by a Southerly spot. To do this, the fragments may bind to DNA probes that have been "radiolabeled" with the mini satellite. In addition to DNA fragments, oligonucleotides may be employed as probes, and they can straightly bind to DNA fragments on gels. A person's specific number of mini satellites influences the size of the constraint fragments, as does the size of the restriction fragments themselves. As a result, it is possible to identify a person based on their pieces. As a result of its utilization of PCR amplification of VNTRs from several alleles, AFLP is a quicker approach than RFLP.

1.5. DNA PROFILING

A person may be identified using forensic DNA profiling, an essential forensic method. Parentage identity examination may also be conducted by this technique. Sir Alec Jeffreys has developed this technology with the help of Peter Gill, and Dave Werrett of the Forensic Science Service to compare the DNA profiles of criminal

[15] C. Kruse, *"The Social Life of Forensic Evidence"* 37(CA: University of California Press Oakland 2016) Cited in H. Machado, R. Granja, *Forensic Genetics in the Governance of Crime*, (Palgrave Pivot, Singapore, 2020) *available at:* https://doi.org/10.1007/978-981-15-2429-5_4 (Last visited on 1st July 2021).

suspects. Furthermore, DNA profiling is now a basic statistical procedure that is easy and automated. In addition, DNA profiling employs a panel of multi-allelic STR markers, which are physically similar to the unique mini satellites. STRs, on the other hand, are significantly shorter than mini satellites, making multiplex PCR a simpler method for amplification. STRs are the four-base repetitions of a sequence. Amplification may be done using sequence-specific primers. Gel or Capillary electrophoresis is then used to isolate the fragments. Capillary electrophoresis can assess up to 30 STRs with one injection. Even though STR alleles are very rare, their polymorphism is remarkable. Alike STR alleles may be found in 5% to 20% of people.

A person may be identified through DNA fingerprinting, while DNA profiling can be used for forensic investigations. UK codified specific laws on forensic DNA profiling in criminal investigation and developed the world's largest DNA data bank to best utilize the technique. DNA profiling is a reliable and authentic tool in a criminal investigation that requires the joint force of forensic scientists, law experts, and investigative agencies. DNA profiling is a technique of forensic science that is useful in the identification of a person, by comparing, the DNA structure with that of the sample found at the crime scene. DNA stands for *Deoxyribose nucleic acid*. In DNA profiling the identity is determined by decoding or interpreting the characteristics of DNA, which exists in every cell of the human body, be it, a man or woman. The capability of DNA technology to identify the victim and accused of a crime, determine the paternity of issues, and establish the identity of victims of natural calamity and war made the revolutionary transformation in criminal justice administration. The technology has obtained a prominence status in the legal system of different countries which have strong and effective justice administration systems. This is because the technique identifies the real culprit on one hand and exonerates the innocent on the other hand, so it is like the double edge sword of justice in human society.

In the year 1990, an unidentified assailant recognized as the "Night Stalker" brutally attacked senior citizens in Goldsboro of North Carolina. Elderly women were raped and just about killed during one such incident in March. The victim's life was just protected when her daughter arrived home early. The suspect left the scene, leaving behind items that may have been used to burn the victim and the victim's

house to hide the murder. A further elderly lady was viciously brutally raped in her residence in July 1990, according to reports. In three months, another elderly lady was raped and murdered. Her spouse was also killed in the attack. To cover up the crime, their home was set ablaze and the corpses were rescued by firefighters and rescuers. Authorities were able to connect the three murders using DNA samples derived from vaginal swabs taken from the female victims. There was, however, no one else to blame. They were not forgotten for 10 years by the police and the Crime Lab at the Goldsboro. [16]Though DNA is not the only forensic tool available for the investigation of unsolved cases, advancements in DNA testing and the success of DNA database systems have inspired law enforcement agencies throughout the country to reevaluate cases previously thought unsolvable.

1.6. STATEMENT OF PROBLEM:

The technique to identify the molecular level of any individual is called DNA profiling. It is a scientific technique that is practically reliable and accurate. Deoxyribonucleic acid also called the genetic blueprint or building block of life in any living being was first introduced by Jams Watson and Francis H.C Crick in 1950.[17] In 1954 scientists affirmed that the information encoded in DNA includes the inheritance of a particular individual's biological genetic character or information. The importance of the scientific technique of DNA profiling in the modern era in the administration of the criminal justice system became crucial when we compare the DNA record from two different sources for example one DNA of biological material found from the crime scene and another DNA of suspects. In common understanding, the identification of an individual requires examination of blood group, finger impression, hairstyle, entire body, and other localized special features. DNA profiling empowers the identification of an individual through the analysis of information stored in the human nucleic cell from any part of the body. The uniqueness of DNA in a human cell, which is made of sexual reproduction, combined the DNA of the mother and that of the father. The human body is made of cells. Cell in the human body is a

[16] Sarah V. Hart, "Using DNA to Solve Cold Cases", *National of Justice, available at*: http: //www.ojp.usdoj.gov/nij. (Last visited on 3rd October 2021).

[17] Dr Nirpat Patel "The role of DNA in criminal investigation Admissibility in Indian legal system and Future Perspective" *available at:*
https://www.researchgate.net/publication/279299013_The_Role_of_DNA_in_Criminal_Investigation__Admissibility_in_Indian_Legal_System_and_Future_Perspectives/download (Last visited on 5th October 2021).

consequence of cellular division. In The process of cellular division, the DNA of an old cell is copied into the newly fertilized cell and is identical in every part of the human body.

While conducting identity tests through DNA profiling, it is not required to have analyses of DNA as a whole, the reason behind this is that about 99.9% of any DNA is almost the same in every human being and just 0.1% of human DNA varies amongst person to person which is efficiently sufficient to identify an individual. The comparable portion of DNA is called non-coding or junk DNA.[18]

DNA profiling can't distinguish between any two identical twins because their junk DNA structure is used to be the same.[19] In the matter of People v. Wesley, the United States apex appellate court based in California observed that DNA profiling is the single greatest advance in the search for the truth, since the advent of cross-examination.[20] It is fact that the neither court nor law enforcement machinery has taken adequate steps to tackle the privacy challenges posed by DNA profiling. The collection of non-consensual or forced genetic material from any individual may cause a threat to the privacy of bodily interiority posed by DNA profiling. We don't have a specific legal mechanism to regulate the use of the forensic technique in a criminal investigation. In various cases, DNA profiling is being made to determine the guilt and innocence of a crime suspect. There is no standard to decide which categories of accused can be forced to provide genetic material for profiling.

The DNA Technology (Use and application) Regulation Bill 2019 provides DNA profiling for civil and criminal purposes. The genetic material for DNA profiling can't be taken without informed consent but the bill doesn't prescribe obtaining consent for DNA profiling for civil purposes. The civil matter provided in the schedule of the Bill was very serious including paternity and maternity determination, use of assisted reproductive technology, and transplantation of human

[18] Geramy Gans & Gregor Urbas "DNA Identification in Criminal Justice System" *Australian Institute of Criminology available at:*
http://www.delhihighcourt.nic.in/library/articles/dna/DNA%20identification%20in%20criminal%20justice%20system.pdf (Last visited on 2nd Dec. 2018).

[19] Moenssens, A. Andre, "DNA Evidence and Its Critics—How Valid are The Challenges?" *Jurimetrics*, vol. 31(1) *American Bar Association (*1990*) available at:*
http://www.jstor.org/stable/29762201. (Last visited on 8th February 2019).

[20] Denise A. Filocoma "Unrevealing the DNA Controversy: People v. Wesley; a step in the right direction" *Journal of law and policy*, Vol.3. 1995. a*vailable at:*
http://brooklynworks.brooklaw.edu/cgi/viewcontent.cgi?article=1475&context=jlp.(Lat visited on May 2020).

organs. The ICCPR has conferred the right on every individual not to compel to testify against or confess guilt.[21] The Declaration of Helsinki, 1964 adopted by the 18th world Medical Association General Assembly sets the guideline and requires informed consent and confidentiality for scientific study. We need to follow the guidelines issued by the DNA Commission of the International Society for Forensic Genetics.[22] The use of DNA profiling for the identification of human bodies of natural calamity, disaster, and terror attacks can be a strong tool to ensure social justice.[23] Due to uniqueness, infallibility, and scientific accuracy in identifying a person in crime detection, many leading nations in criminal justice administration introduced DNA technology for criminal detection.

As a consequence of this United Kingdom created a statute named Criminal Justice and Public Order Act 1994. The USA passed the law called DNA Identification Act, 1994. Unfortunately, there is less development in India for incorporating the use of DNA profiling for criminal detection. Here in India, the technology is being given some recognition by introducing a few amendments in Procedural law. The criminal justice institution generally uses DNA profiling to solve crime mystery and criminal detection in anyone of the following ways, which includes:

- First: compare the evidence from a crime scene with the DNA profile of the suspect, in the case, where the suspects are identified.
- Second: Analyzing and comparing the biological evidence found at a crime scene with that of the offender's DNA profile stored in the National DNA database bank, where the suspect is not being identified.
- Third: linking of crime scene evidence to the other crime scene evidence of DNA profiling in the DNA database.

Further, the technique of DNA profiling can be used to prevent possible future crimes. This is because of surveillance on habitual criminals whose DNA data will be stored in a data bank which is taken at the time of conviction. But there is no law providing practical application of the technique of DNA profiling effectively in India.

[21] Article.14(3)(g) ICCPR 1966
[22] Published in FSI Genetics, Forensic Science International Genetics 1 (200)
[23] ICRC, Missing People DNA analysis and identification of Human remains, *available at:* https://www.icrc.org/en/doc/assets/files/other/icrc_002_4010.pdf (Last visited on 10th May, 2019).

We do not have the legal and scientific infrastructure to implement the technology in a wide range needed of time. Despite many burning issues and challenges are coming out as a consequence of the introduction of a new scientific technique of DNA profiling in a criminal investigation. The conflict between DNA mechanisms and the fundamental rights of individuals poses a serious challenge to the state. Right to privacy, and the right against self-incrimination is the main challenge in consequence of this the court is generally hesitant in accepting and directing to have DNA profiling of the criminals to identify the real culprit. There is a need to establish a proper balance between technology and the conflicting rights and other interest of an individual in society.

1.7. OBJECTIVE OF RESEARCH:

The objective of the study shall be

1. To make descriptive-analytical research on the evaluation and development of DNA profiling in a criminal investigation.
2. To have a Descriptive Analytical and Theoretical study of DNA profiling as a scientific tool of investigation in criminal procedure in India and a quantitative and empirical study on the application use and significance of the Technique
3. To have an empirical study on the use of DNA profiling in criminal investigation and to look at the vulnerability of various rights or interests of the accused person of any offence, victim, and common person.
4. To study the possibilities of infringement of privacy and other human rights of individuals.
5. To study the level of awareness about DNA technology among different stakeholders viz., investigation officers, judicial officers, lawyers and forensic experts with the help of quantitative data.
6. To discuss and analyze various rights and interests of all stakeholders having interests in criminal justice administration.
7. To have an inquiry on the institutional framework responsible for the implementation of the forensic DNA database.
8. To enquire into the challenges whereby the legislature repeatedly meets failure in passing of DNA Technology Regulation Law in India.

9. To critical analysis of the various DNA Profiling Regulation Bills and Law Commission of India's report.
10. To have an in-depth enquiry on the functioning of Forensic Science Laboratories in India and the institutions responsible for standardization of the technology for investigation.
11. To analysis of the DNA profiling Bill to find out legal loopholes and look forward to the possible solution available in technologically developed nations.
12. To investigate and analyze the institutional framework constitutional working and responsibilities of a forensic science lab with the help of qualitative and quantitative data and also to highlight the challenges faced by forensic science labs.
13. To critically analyze the legal framework of DNA profiling in India and to discuss the relevant judgments related to DNA profiling.
14. The study shall make a comparative analysis of the DNA profiling mechanism prevalent in the United State of America and the United Kingdom and other technically flourished countries.
15. To have an enquiry on the DNA profiling mechanisms and standards which are being used in the leading criminal justice systems.

1.8. RESEARCH QUESTIONS:

1. How the technique of DNA profiling has evolved and developed in genetics, how much the application of DNA technology is significant in a criminal investigation?
2. What is the level of awareness of the application, use and significance of DNA profiling among the law students, lawyers, legal experts, judges and police officers?
3. How much the DNA profiling infringes various human rights, especially the right to privacy of an individual?
4. What is the role, contributions and duties of forensic science labs in the implementation of DNA databases in a criminal investigation?
5. What is the legal framework for DNA profiling in a few developed countries like the USA, UK, and Canada?

6. What is the role of law in protecting the right and interests of affected persons?
7. What is the response of the judiciary in India as well as in foreign countries on the applicability of DNA profiling in different cases?
8. What are the loopholes and lacunas in the present legal framework of DNA profiling?
9. What may the changes and reforms have required for the effective implementation of DNA technology in a criminal investigation?
10. Whether the scientific evidence of DNA profiling can be used and admissible as a general rule to rebut the presumption of paternity under sec.112 Indian Evidence Act?
11. What are the potential challenges in consequence of which the Indian Parliament repeatedly failed in enacting the DNA profiling law in criminal investigation the researcher will find out the possible solution available in a technically advanced nation like the US and UK compatible with the Indian situation?
12. Whether the role of the Forensic Science Laboratory based in Lucknow is satisfactory and Efficient in criminal investigation, are they practically up-to-date with the current forensic science standard as prevalent in countries like US and UK?
13. What is the standard of collection storage and analysis of genetic material for the DNA database, who would have the right to access and use of DNA database, which authority is responsible for its safety, and what is the remedy available to victims of whose right got infringed?

1.9. HYPOTHESIS

The research will be concentrating on testing the following prepositions under the thesis: -

- The evolution of DNA technology and the prevention of the crime rate has a direct correlation in any criminal justice system. The forensic technique of investigation is not violating the human rights of the accused but it is a protective mechanism because it ensures a better investigation and trial of the accusation.

- The collaborative and collective effort of bar bench and law enforcement agencies along with the forensic Science Laboratory will ensure a better crime preventive mechanism in India like UK and USA.
- The legal institutional framework to deal with the use and applicability of DNA profiling in criminal investigation in India isn't adequate to cope with the constitutional challenges.
- The capabilities of DNA profiling have not been fully applied in India due to the lack of specific laws and regulations on its use and misuse. It is because of multiple reasons like lack of political Will, unsatisfactory Forensic Science experts and laboratories and necessary infrastructure, and insufficient forensic trained investigation staff in the police.

1.910. RESEARCH GAP

The earlier studies on DNA Profiling couldn't emphasized on due interference between application of DNA technology base criminal investigations in Indian criminal justice administration. The researcher also focused on the dearth of material on legal framework of accountability responsibility of investigation agencies and forensic science laboratories in India.

1.10 RESEARCH METHODOLOGY

The methodology used in this study is non-doctrinal and empirical which involved an in-depth study of the source materials, text reviews, case studies, survey through and extensive analyses of both descriptive and analytical. It also traces the legislative development at national and international levels.

Primary as well as secondary sources like legal texts, books, articles, encyclopedias, research papers, newspapers, publications of special institutions of leading nations on dealing with forensic science, and legal issues related to scientific techniques of DNA profiling in criminal justice administration in India and the internet material have been referred to get the most pertinent information.

1.11 LIMITATION OF STUDY

The study was confined to Lucknow city due to the pandemic era due to covid19, which caused obstacles to conducting an empirical study on the function of the Forensic Science Laboratory. The study was limited to a specific period and a limited

number of papers. Due to some constraints, the study is based on the evolution of the role of the Supreme Court and the High Courts in India which are related to DNA profiling in a criminal investigation. The court's ruling and laws concerning the forensic science of DNA profiling are covered from 1991 to 2022. The law and judgments are being analyzed for DNA profiling in a criminal investigation about the offence of rape and murder cases, rape cases, assassination cases, and the case of unnatural offences and murder.

1.12 RESEARCH DESIGN

The research design is descriptive as well as empirical. The descriptive research design studies search for accurate observations and the empirical research design is focused on the validity or accuracy and reliability or consistency of the observation and the representativeness of sampling.

This research work is confined to a limited period duration from 2018 to 2022. Therefore, the cross-sectional design has been used rather than the longitudinal research design. Cross-sectional research refers to a study which takes a snapshot of a situation in time. It examines how something is done at the time of the research study. It measures a particular unit from a sample of the given population at one point in the period.

1.13 UNIVERSE OF RESEARCH

The population of the research study Consists of all the stakeholders of the criminal justice administration. In detail, the population of the study consists of Forensic Science Experts of CFSL Lucknow, Advocates, Law Academicians and Judicial Officers throughout the state of Uttar Pradesh and law Enforcement officials (Police Officials) of all police stations in Lucknow city. The Total population or sample size is 626 (101 Forensic Experts + 424 Law Scholars + 101 police officials).

1.14 SAMPLING UNIT

The units of sampling comprise Advocates, Law Academicians, Forensic Science Experts of CFSL Lucknow and judicial officers throughout the Uttar Pradesh and law Enforcement officials (Police Officials) of all police stations in Lucknow city.

1.15 SAMPLING SIZE

The researcher has adopted systematic sampling method and snowball sampling technique in conducting the survey. The total sample size is 626 (101 Forensic Experts of CFSL Lucknow + 424 Law Fraternity + 101 investigation officers or police officials in all the police stations of Lucknow city.

1.16 METHOD OF DATA COLLECTION

The category of Data collected and the size of data collection depends upon the nature of the study and the research objectives behind the study. In this research study, the researcher has used primary data and the secondary method of data collection. The primary method of data collection comprises the closed-ended structure of a questionnaire survey for collecting the primary data. The secondary method of data collection for secondary data comprises research journals, articles, judgments of courts and Internet web browsers and Books.

1.17 STATISTICAL TOOLS OF DATA ANALYSIS

Once the data collection was done, it was converted into tabular and coded form and was analyzed by using both descriptive and inferential statistical techniques. Mean, standard deviation and range have been calculated to draw a profile of the respondents and their respective responses. The various sets of data collection were analyzed on the statistical software called SPSS (Version 21).

1.18 LITERATURE REVIEW

The Selective literature review has been done by the researcher to reach the appropriate core of the topic and to identify the issue and challenge on which research can be done which would have social utility. The literature review intends to identify legal loopholes in India's justice system which is responsible for the failure of proper incorporation and implementation of new technology in the criminal administration. The literature includes a reference book, a Report of a law commission, a judicial decision of the Supreme Court, High Court in India, United States of America and England. The literature includes Journals, Articles and News Papers on national and international platforms.

10.18.1. BOOKS

Jyothirmoy Adhikary, DNA Technology in the Administration of Justice, Lexis Nexis Butterworths, New Delhi, 2007.

The author of this book exposed the innovative scientific technology of DNA profiling in criminal justice administration this book is being bifurcated into six chapters. The author describes the current development in the field of forensic science of DNA profiling and explains how the technology promises accuracy and infallibility. The author explained the possibility of the use of DNA profiling in criminal investigations and civil matters. The book contains information on DNA profiling till 2005. The book wisely narrates scientific aspects of DNA profiling, methods of DNA profiling, and the procedure for DNA profiling. The author of the book describes the three main methods of DNA profiling.

Polymerase Chain Reaction (PCR), Restriction Fragment Length Polymorphism (RFLP) and Short Tandem Repeats (STR). The author describes the method of the sample which is a biological material collection for DNA profiling, storage or preservation of biological material or sample and analytical procedure for a DNA test. The description is in a very clear and simple way. The author emphasizes that the method of DNA profiling is the latest technique in forensic science. He explores the recent development in technology from an international perspective.

R.J Parker and Peter Vronsky, Forensic analysis and DNA in Criminal Investigation: including cold cases solved, Create space Publication, 2015 –

The latest in Forensic techniques and recent Cold Cases are solved with photos with clear explanations, this book is intended as an introductory guide and reference to forensic techniques for front-line police officers, criminal attorneys, journalists, mystery fans, and armchair sleuths, and crime authors. This encyclopedic book is a must-read for any true crime aficionado. Parker and Dr Vronsky explored the examples of true cold cases in which forensic science was essential, not only identifying the guilty person but also exposing the innocent and protecting the wrongly convicted. We must express our gratitude for DNA analysis and new techniques, because of the technique many cases once thought hopeless and impossible are being resolved.

The book provides the gradual development and history of forensic science and its contribution to the criminal justice system. As always, Parker excellently keeps the reader on the edge of his seat as he describes how forensic science and the technique of DNA analysis contribute to solving complex and mystifying cold criminal cases. This book is a must-read for the acquisition of professional skills in the science of forensic DNA profiling. And whoever is interested in the evolving science of criminal investigations.

Yeshpal Singh and Hasan Zaidi "DNA Tests in Criminal Investigation, Trial and Paternity Disputes (Justice through Science)"

In recent years DNA Profiling has been widely used as a universally accepted advanced scientific technique in solving complicated criminal matters all over the world in the field of law. The cases are proved in the court of law based on oral and documentary evidence but there remained every possibility that the evidence may be destroyed or tampered with. This is not so in the case of DNA evidence. It cannot tamper with nor does it tell a lie. In absence of reliable material in the field of scientific matters such as DNA profiling in India the court sometime felt helpless. This book fulfils the vacuum. The authors and their companions and contributor have taken great points to explain the subject in a very clear and authoritative manner. The matter provided in the book covers practically every field of scientific approach toward solving and deciding the complex case. This book explains genetic science, the position of pre-and post-conviction DNA testing in India and the top scientific developed nation of the world. The author has critically examined the issue of privacy in the use of DNA profiling

Sarla Gupta& Beni Prasad Agrawal "DNA test in Criminal and Paternity Disputes (Scientific Investigation & trial).

This book covers various facets and suspects of DNA profiling as an advanced scientific technique in solving complicated questions of facts in legal cases and traces evidence – small in quantity but beneficial quality-wise. Genetic profiling based on inherited genetic variation acts as a forensic tool to facilitate proper and complete investigation and resolve many civil and grave offences punishing the criminals. As per the author use of DNA profiling in a criminal investigation does not violate the right to privacy enshrined under Art.20 (3) of the Constitution of India. DNA

evidence is admissible in sec. 45 of the Indian Evidence Act as scientific expert opinion. The code of Criminal Procedure (Amendment Act.2005) has also included DNA profiling in the examination of the accused of a criminal investigation under sec. 53 and 53A of the criminal procedure, 1973. The government of India has also prepared a DNA profiling Bill in line with Police and Criminal Evidence Act, 1984, DNA Identification Act. 1994(US), Crime Forensic Procedure Act, 2000 (Australia), and DNA Identification Act, 2000 (Canada). The Bill has invested the power in the court to make an order for carrying out the forensic procedure of DNA evidence in a non-consenting matter of the accused.

David E. Newton *DNA Evidence and Forensic Science* (Publisher Facts on File, Incorporated 2010)

The author considered the dilemmas being faced by professionals and volunteers who are aiming to provide for all complex issues relating to DNA profiling. It explains and critically examined the use of DNA Evidence and Forensic Science in a criminal investigation. The book provides the guidelines and scope for further research in the relevant field.

V. R. Dinkar, Justice in Genes *Evidential Facets of Forensic DNA Fingerprinting* (Asia Law House, Hyderabad, 1st Edition 2008)

In this book, the author described the concepts methods and techniques of DNA profiling. The book is bifurcated into six parts. The matter of admissibility of DNA profiling in evidence for criminal identification has been elaborated in a simplified manner. The author has taken up the positive and negative aspects of the technique of DNA profiling. The book is focused on the concept and is influenced by the existing trend of DNA profiling in the United State of America. There is commentary in the book criticizing the capacity and role of the Indian judicial system which is incapable from in legal and physical infrastructure perspective. It mentioned the less equipment of judiciary in India while dealing with the technique of DNA profiling in criminal investigation and identification to prevent crime and punish criminals. The author dealt with the technique of DNA profiling from a legal and constitutional perspective and highlighted the issue and challenges we are facing in India in implementing the technique on the ground reality.

Dr B. R. Sharma, Forensic Science and Criminal Investigation and Trials, (Universal Law Publishing Co., 4th Edition, 2003)

This book titled "forensic science and criminal investigation and trial cover almost every aspect of forensic DNA analysis and scientific investigation. of crimes and criminal. The author explains the manner, in which the modern technique of forensic science of criminal investigation has changed the nature and the role of a criminal investigation. The author mainly took up the two methods of DNA profiling and explored almost every scientific aspect thereof first Polymerase Chain Reaction and second Restriction Fragment Length Polymorphism.

Dr Gupta & Agarwal, Medical Jurisprudence and Toxicology [Practice and Procedure], Premier Publishing Co, 1st Edition, 2011.

It is a book on medical jurisprudence this book is bifurcated into 85 chapters. The chapter-68 of the book is provided for the technique of DNA profiling in criminal investigation. The author deals with the implementation of forensic technology of DNA profiling in criminal investigation and crime detection. He also emphasizes the use of technology in civil matters. The author explained the theoretical aspect of DNA profiling and highlighted the issue and challenges in the practical application of the technology.

B. S. Nabar, Forensic Science in Crime Investigation, Asia Law House, Hyderabad, 3rd Edition, Reprint 2007.

The book on forensic science in criminal investigation systematically describes the historical development of DNA profiling and the initiation of its use in the criminal investigation. This book explores every aspect of DNA fingerprinting in India. This book especially deals with the issue of paternity determination by the use of DNA profiling in India.

ARTICLES

Mark A. Jobling and Peter Gill "Encoded Evidence: DNA in Forensic Analysis", Journal of Nature Publishing Group, (2004)

This article "it has long been an axiom of mine that the little things are infinitely the most important", but never imagined that such a little thing, the DNA molecule, could become perhaps the most powerful single tool in the multifaceted fight against crime.

Twenty years after the development of DNA fingerprinting, forensic DNA analysis is key to the conviction or exoneration of suspects and the identification of victims of crimes, accidents and disasters, driving the development of innovative methods in molecular genetics, statistics and the use of massive intelligence databases.

Subhash Chandra Singh "DNA Profiling and The Forensic Use of DNA Evidence in Criminal Proceedings" Journal of Indian law institute, Vol.53, (2011).

The author emphasizes that DNA testing has become an established part of the criminal justice process, and the admissibility of the test results in the courtroom has become routine. There is not and has never been controversy about its ability to eliminate suspicion in cases where the suspect's DNA does not match the evidentiary sample. Debate continues, however, concerning the extent to which the guilt can be inferred when an apparent match occurs. In most cases, the best it can ever do is to place a suspect at the scene of the crime. However, the uncritical adoption of 'forensic biologic evidence' as the objective solution to the problem of determining criminal identity raises the possibility of 'scientific appropriation' of the criminal justice process and ignoring the fact that in most contested criminal cases, the crucial issue is not identity but of consent or men's rea, for which DNA evidence provides no assistance. This paper examines the current debate over the many roles that DNA can, and should, play in criminal justice.

Noa Vaisman "The Human, Human Rights and DNA Identity Tests" ***Sage Publication Journals, Vol- 43, issue 1, (2018***)

The papers examine a variety of scientific technologies—personalized medicine and organ transplant, mitochondrial DNA replacement, and scaffolds and regenerative medicine— and their implications for our conceptualization of the human subject. Each is then followed by a commentary that both brings to light new dimensions of the original paper and presents a new theoretical take on the topic. Together these papers offer a serious challenge to the vision of the human subject at the root of human rights law. Instead of the autonomous, rational, unique, and physically discrete individual who owns herself and her body, the subject that emerges from the human technology assemblage has physically porous boundaries and a relational self. This depiction of the human being as a relational subject enmeshed in her techno-scientific environment requires that we re-conceptualize human, rights law and practice

Runa Daniel & Simon J. Walsh "The Continuing Evolution of Forensic DNA Profiling" Australian *Journal of Forensic Science*, Vol- 38, Issue-2, (2009).

Forensic DNA profiling combines the dynamic science of molecular genetics with the complexities of the forensic context. As such, throughout its twenty-year history, this field has seen continuous change, remarkable growth and an associated level of public, legal and scientific scrutiny previously unknown in the forensic sciences. Almost ubiquitously, applications of forensic DNA profiling have focused on resolving the identity of the donor of a particular sample of biological evidence. This is typically achieved by targeting non-coding microsatellite (or STR) loci. Recently, however, novel techniques have emerged that target different DNA polymorphisms and allow scientists to address additional questions. about the evidence, beyond the identification of the source. In this short review, we introduce an example of this next generation of forensic DNA techniques, single nucleotide polymorphisms (or SNPs). We summarize their molecular and technological basis and how they may be applied to further advance the capabilities of forensic investigators

Dr Durga Pada Das, "DNA Fingerprinting and its impact on the Administration of Criminal Justice" *MLJ Cri. L.* J, Volume-4. (2005)

The author of this book explained the impact and role of DNA fingerprinting on the administration of justice. The author also explains the importance of DNA fingerprinting in criminal justice investigations. The author especially expresses that the quality of the criminal justice system in India will be at its peak if DNA technology is implemented properly.

Dr Subodh K. Singh, "Application of DNA profiling in the Administration of Criminal Justice" MLJ Cri. L.J, 2011.

This article explains the technique of DNA proofing from a national and international perspective. The author explores the status of DNA forensic analysis and its use in the leading criminal justice system in a court of the European Union, the United State of America, and Britain in deciding criminal cases.

In the United States and the United Kingdom courts have frequently taken the help of the forensic technique of DNA profiling as evidence in deciding criminal cases. In India, DNA profiling plays a crucial role in identifying the paternity of children. In this book the author the judgment of the Supreme Court in the matter of Sharada v.

Daharmpal.6 In this case, the Apex Court has taken a very positive view regarding the significance and the admissibility of DNA evidence. The author presented an analysis of section 112 of the Indian Evidence Act, 1872. The author has given a good explanation of DNA that how it is an instrument for identification in a criminal investigation. The author gives very good pieces of examples as evidence on criminal matters like as rape, murder, and other heinous crimes, where the identification of criminals was impossible but the application of DNA technology made it possible to identify the culprit thereby saving many innocents from becoming the subject of injustice. The author expresses his view that the role of judges is very crucial for the application of DNA profiling in a criminal investigation as evidence. The author is recommending special training to all wings of investigation and justice institutions for proper assessment and implementation of forensic DNA technology.

1.19. SCHEME OF CHAPTERS

CHAPTER:1. INTRODUCTION

The introduction consists of the interpretation of the idea of DNA profiling and its role in a criminal investigation. It also gives the historical evolution of the technique of DNA profiling from a scientific and legal point of view as well. It covers Hypotheses, Research Questions, Research Methodology and Literature review. This chapter consists of the outline of the Research Thesis in the form of a tentative chapter plan.

CHAPTER:2. SCIENTIFIC CONCEPTUALIZATION OF FORENSIC DNA PROFILING TECHNIQUE.

This chapter comprises the science of DNA technology and its evolution. This chapter comprehensively provides the methods of DNA profiling and the advantage and disadvantage of a particular method of DNA profiling. It is provided herein in this portion how Sir Alec Jeffrey has developed and applied the Restricted Fragment Length Polymorphism. Thereafter it elaborates on PCR, STR, Mitochondrial DNA analysis so on. It also covers the

CHAPTER:3. FORENSIC DNA PROFILING IN CRIMINAL INVESTIGATION: AN INTERNATIONAL ANALYSIS

This chapter examines the status of DNA technology and its role in the criminal investigation of the world's leading criminal justice systems. It presents a comparative picture of the DNA technology for a criminal investigation in different countries. Including the United Kingdom, USA, Australia, Canada France, and India. The study covers the principles of Admissibility of DNA Evidence like the **Frye Test of Scientific Evidence** under which it is understood that scientific evidence and the evidence or innovative technique would be admissible as evidence in determining general acceptance according to the Frye standard if it satisfies the two requirements

i. identifying the fields into which the scientific principle or discovery falls and the relevant scientific community; and
ii. determining whether that community accepts the technology, principle, or discovery. Scientists in the relevant fields must generally accept both the underlying theory and the procedures used to produce results

The second principle of admissibility of DNA evidence is the **federal standard** this standard is flexible in comparison to **the Frye test of admissibility**. There is an analysis of American special Statutes and laws like the DNA Analysis Backlog Elimination Act 2000, which empowers the states to carry on the Combined DNA Index System (CODIS) and Authorizes the Director of the Federal Bureau of Investigation shall have the power to maintain the protocol of Quality Assurance Standards in all the States about the standards of forensic Science Laboratory. Another statute is the Justice for All Act 2004 which tackles specific cases of crime and the use of DNA profiling in the investigation of such specific crimes. In the same line, we have taken in detail probably all the Statute Judicial decisions of the Highest Court in USA, UK, Australia, Canada and India and based on such comparative analysis put forward some recommendations to refine and update the legal and technological framework for DNA profiling in India.

CHAPTER:4. FORENSIC DNA PROFILING IN CRIMINAL INVESTIGATION: NATIONAL LEGAL FRAMEWORK.

The DNA test gained legal recognition in India in 1989 in the case of Kunhiraman v. Manoj[24] and before that by the Court of C.J.M. Court of C.J.M., Tellicherry, Kerala in Case No. 170 F1988 decided on 24.4.1990 and the Court accepted this test to decide the paternity and it was held admissible in evidence under Section 45, Indian Evidence Act. In the same case, Dr Lalji Singh[25] appeared as a forensic expert and the Court observed that when opinions of fingerprint experts and chemical experts and ballistic experts can be admissible why the evidence of DNA experts be not admissible in evidence and in an appeal against the order the High Court upheld the decision of lower Court

DNA Evidence was accepted as an expert opinion in a case and this verdict was upheld by the High Court. The Court recognized and gave its due importance as expert evidence in deciding several cases but so far it has not been given its proper place in the Indian Evidence Act and other related statutes. Due to the absence of statutory recognition, a situation of confusion and uncertainty prevails over the subordinate judiciary. The need of the hour is that it should be used as a powerful tool of investigation and the direction of Courts should base upon it. Regarding the admissibility of such a test, the Andhra Pradesh High Court held in **Balrama Venkata Ganesh v. State of A. P**[26] that such evidence is admissible in Courts in deciding the issues involved. It appears that though the Courts in India have already recognized the importance of DNA by accepting it as expert opinion under section 45 of the Evidence Act and have been accepting this type of evidence, it is Legislature that is lagging and the need for the hour is to provide legislation on this subject. The Apex Court in ***Kamti Devi v. Poshi*** Ram has observed that scientific advancement with DNA as well as RNA tests was not even in contemplation of the Legislature. The result of the genuine DNA test is said to be scientifically accurate.

[24] (1991) 3 Crimes 860 (Ker).
[25] Chetana Sachidanandan **,** K. Thangaraj **,** Lalji Singh (1947-2017): The pioneer of DNA evidence Lalji Singh (1947-2017): The pioneer of DNA evidence *available at:* https://indianexpress.com/article/opinion/columns/lalji-singh-the-pioneer-of-dna-evidence-fingerprinting-4978502/ (visited on 10th September 2021)
[26] (2003) Cri LJ 4508 (4518).

In ***Chandan Panalal Jaiswal v. the State of Gujarat***, the Court posed the question of whether the investigating agency can be conferred with authority to resort to a DNA test in absence of any special law enacted by the Legislature. It is submitted that under the Cr. P.C. enormous powers have been given to investigating agencies to bring the accused to book. It can safely be said that now there is no specific prohibition for use of DNA in solving crime. **Nandalal Vasudeva Badwaik v. Lata Nandalal Badwaik**[27] held that the test of DNA profiling shall prevail over the conclusive legal presumption which the court is bound to follow under sec. 112 of the Indian Evidence Act. Whist delivering judgement J Chandramauli Kr. Prasad observed that the scientific technique of DNA profiling was not in existence, and the accuracy of the result was not even in the contemplation of the legislature. It's a need of time that the traditional method of evidence should be replaced with a scientifically accurate and acceptable method of evidence. Section 53 and section 53A authorized DNA examination of the accused at the request of the police officer when their reasonable ground that evidence may be found for proving the guilt of the accused in the case when the accused is a sexual offender. Under section 164A the medical examination of the victim of rape shall be done by the registered medical practitioner and such examination will include DNA examination as well. Thus, there is no provision under the Criminal Procedure or Indian Evidence Act authorizing DNA profiling or test to investigate crime in general. In the year 2006, the DNA profiling Bill was introduced very first in Parliament to provide specific legislation for use of DNA profiling in criminal and civil matters. Recently Dr Harsh Vardhan, the Minister for Science and Technology introduced the DNA Technology (Use and Application) Regulation Bill, 2019[28], in the House of People. The Bill was produced for providing specific laws regulating the use of DNA technology for the identification of a certain person. The bill provides that government shall obtain biological material for DNA profiling with the consent of individuals accused of an offence punishable with up to seven-year of imprisonment or less. But the consent shall not be necessary for the collection of biological material if a person is accused of an offence punishable with imprisonment of seven-year or death. The Bill directs that the standard for collection, entry, retention, and removal of DNA profiles shall be as per the regulation. But the

[27] AIR 2014 SC 932.

[28] DNA Technology (Use and Application) Regulation Bill, 2019 a*vailable at:* https://pib.gov.in/PressReleseDetail.aspx?PRID=1559099# (Last visited on 24th January 2021.)

bill failed in the upper house and collapsed. There is no specific provision for DNA evidence in Indian Statutory Laws. DNA admissibility is a pressing need of the present time because many cases are pending for lack of such evidence. At this stage, the Government of India should take necessary steps to make laws regarding DNA tests/evidence like the U.S.A., Canada, and other European countries.

CHAPTER:5. DNA PROFILING IN CRIMINAL INVESTIGATION AND RIGHT TO PRIVACY IN INDIA

India is a signatory to International Covenant on Civil and Political Rights, 1966 further article 21 of the constitution of India includes the fundamental Right to privacy as established in Justice**, K.S. Puttaswamy case**[29].

> "No one shall be subject to arbitrary or unlawful interference with his privacy, family and home, or correspondence, nor to unlawful attacks on his honour and reputation; does everyone have the right to the protection of the law against such interference or attacks."[30]

In **M. Vijaya vs. The Chairman, Singareni Collieries**, the Court, upon a detailed discussion of the competing rights of a private party and public right concerning the right to privacy of a person suspected of suffering from AIDS, held:

> "In the interests of the general public, the State must identify HIV positive cases and any action was taken in that regard cannot be termed as unconstitutional as under Article 47 of the Constitution, the State was under an obligation to take all steps for the improvement of the public health. A law designed to achieve this object, if fair and reasonable, in our opinion will not be in breach of Article 21 of the Constitution of India. It is well-settled that the right to life guaranteed under Article 21 is not mere animal existence. It is a right to enjoy all faculties of life. As a necessary corollary, right to life includes right to a healthy life." [31]

The investigating agencies and courts have an important objective in seeking the truth. In all criminal proceedings, an accused is assumed to be innocent until there is no reasonable doubt that the accused is culpable. The principle of innocence should be dealt with as the human rights of the accused according to Article 11 of the

[29] (2017) 10 SSC 1
[30] International Covenant on Civil and Political Rights, 1966, Art. 17.
[31] A.I.R. 2001 A.P.502: 2002 AIHC 475.

Universal Declaration of Human Rights (UDHR), 1948.[32] The ICCPR, article 14(2), 1966 (ICCPR). Article 14, paragraph 2.[33] Therefore, it is very often seen that the State takes various steps without any reasonable doubt to establish the case. In nearly every criminal prosecution that leads to egregious abuses of the basic rights of people, investigative agencies and courts encounter new types of evidence as they do their job. The development of criminal investigations and their subsequent proceedings will affect an individual's rights and personal freedoms. Indian courts have various significant issues with the acquisition of DNA samples so investigative authorities always have a serious handicap to further investigate

The purpose of this Chapter is to examine concerns about whether DNA testing violates individual constitutional rights, i.e., privacy, freedom, life, and personal freedom. We have taken up the judgements of the supreme court of India on the right to privacy from ***MP Sharma v. Satish Chandra*** (Dalmia Groups Search and Seizure Case) ***Kharak Singh v State of UP*** (Surveillance case), PUCL v. Government of India (leader's Phone tapping case) and KS Puttaswami cases.

CHAPTER 6. DNA PROFILING AND FORENSIC SCIENCE LABORATORIES IN INDIA

This chapter encompasses the core of the empirical study related to my research topic and data analysis. It will analyze the functioning of the FSL Lucknow. The laboratory infrastructure is compatible with Forensic testing. Availability and workload level and proficiency in forensic scientists' functioning would also be analyzed. The methodology which is being used in forensic testing of DNA profiling will be examined to test the uniformity of the result of the testing. In India Directorate of Forensic Science Services was established in 2002-03 to help in the administration of justice by providing knowledge and facilities to various training programs to people involved with justice delivery. M.S. Rao was the founding director of DFSL.

[32] Article 11(1) of Universal Declaration of Human Rights 1948.
Article 11 UDHR:

1. Everyone charged with a penal offence has the right to be presumed innocent until proved guilty according to law in a public trial at which he has had all the guarantees necessary for his defence.
2. No one shall be held guilty of any penal offence on account of any act or omission which did not constitute a penal offence, under national or international law, at the time when it was committed. Nor shall a heavier penalty be imposed than the one that was applicable at the time the penal offence was committed.

[33] Article 14(2) of Universal Declaration of Human Rights 1948.

The Forensic Science Laboratories is the agency of the government of India Ministry of Home Affairs, which functions under the control of the Directorate of Forensic Science Laboratories. It provides scientific aid in the criminal justice system. It guides, regulates, and controls the working of Forensic Science Laboratories.[34] The DFSL also provides financial and technical to forensic laboratories. The DFSL promotes research and development in the area of the forensic field in the country. There are three categories of Forensic Science Laboratories which include 1. Central Forensic Science Laboratories, 2. State Forensic Science Laboratories, 3. Mini and Local Forensic Science Laboratories.

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 utilization 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. Forensic science labs in India have several regulatory challenges, which are addressed in this chapter. According to the examination of the Indian framework with systems in operation in other countries, there is a serious defect: there is indeed a lack of empirical study and scholarship on the internal working of forensic science labs and the many scientific approaches they use. For this reason, we argue in this chapter that current laboratory regulations, although important, have not been thoroughly assessed throughout time. A consequence of this is that our justice delivery systems, from pre-trial forward to sentence, are no longer well understood, and the courts' decision-makers are increasingly relying on defective and inaccurate forensic evidence.

CHAPTER 7 EMPIRICAL STUDY AND DATA ANALYSIS

In this chapter, the data was collected by offline mode physical questionnaires filled from different stakeholders and also an online mode of data collection by using google form reach different respondents through Email and WhatsApp. Once Data collection was over, the record of the survey was codified on the statistical software

[34] Report on a prospective plan for Indian Forensic *available at*: https://mha.gov.in/sites/default/files/IFS%282010%29-FinalRpt_0.pdf. (Last visited on 14th May 2019)

known as "SPSS. 21 the survey was shown through graphs and tables with a variety of statistical tools. The population of the research study Consists of all the stakeholders of the criminal justice administration. In detail, the population of the study consists of Forensic Science Experts of CFSL Lucknow, Advocates, Law Academicians and Judicial Officers throughout the state of Uttar Pradesh and law Enforcement officials (Police Officials) of all police stations in Lucknow city.

CHAPTER 8. CONCLUSION AND SUGGESTION

This chapter comprises the conclusion of the whole thesis of the research work of the research scholar. In the conclusion of the thesis, the research scholar concluded and framed certain suggestions which are very crucial for the implementing of DNA technology in the criminal investigation in India.

Crime directly affects peace progress and public welfare in society. Since time immemorial, crime exists in one or another form, everywhere, there is human society. As per the pace of time and technological advancement of society, the methods and techniques adopted by criminals in committing crimes have transformed into an extraordinary change. Criminal implements many complex and hi-tech tactics in committing a crime so that they could easily escape from being caught and punished by law enforcement agencies or the police. It renders the traditional methods of interrogation incompetent to thwart the criminal and requires more advanced and scientific methods to detect crime and criminals in an investigation.

Every organized society has a system to prevent a breach of law, enforce laws, handle lawbreakers, and assuage the victims of crime and their relatives, so that the individual and the society have confidence in its criminal justice system that it will protect them and punish the culprit. Further, the system is bound to bring criminals on the right path through psychological treatment, education, and job therapy. Only then, the society or the country can function smoothly and its members or citizens live without fear and work peacefully. The management of crime, framing of laws, law enforcement, and handling the aftermath of the law enforcement processes is a collective criminal justice system. The main aim of an efficient criminal justice system is "to enforce the specified standards of conduct, rules and laws"

Chapter II on the scientific conceptualization of DNA Profiling technique discusses that innovative science and technology are immeasurably contributing to

criminal investigation and better administration of criminal justice in the modern era. Many scientific techniques are playing a decisive role in criminal investigation and crime prevention in our society in the modern era of science and technology. The technology that aids the criminal justice administration many folds include electronic tools viz. stingray technology, GPS satellite, CCTV surveillance, lie-detector or polygraph test, Narco-Analysis, Brain mapping, Biometric Security measures and the Forensic technique of DNA profiling for criminal investigation. These tools of investigation are widely approved and used by the majority of well-established criminal justice systems in the world's countries.

The role of Scientifics technologies in Criminal Investigation and law enforcement in modern criminal justice administration is very crucial. The police forces use many scientific tools and technologies in criminal investigation to detect real offenders and criminals. The purpose of the law is to ensure the protection of the innocent and to prevent the acquittal of the guilty, in doing so the law serves as a tool. When the legal system works in collaboration with science and technology, for the identification of criminals and penalizing the accused involved in the commission of a crime, the law becomes a powerful criminal justice mechanism to ensure public safety and order in society

DNA profiling for criminal investigation is considered one of the most reliable techniques for criminal investigation. The term DNA stands for *Deoxyribonucleic acid.* The DNA of a human being is found in the nucleus of every cell of the human body. In 1881 the Nobel Laureate German biochemist *Albrecht Kossel* was credited with coining the term DNA by recognizing *Nuclein* as nucleic acid Thereafter he isolated the five-nitrogen base which is considered the basic building blocks of DNA and RNA namely "ACGTU" which stands for 1: Adenine, 2: Cytosine, 3: Guanine, 4: Thymine, and 5: Uracil respectively. DNA Profiling was first ever used as evidence to identify criminals in the year 1986 it was the well-known United Kingdom in the criminal case named R v. Pitchfork where the fact was that the criminal was involved in the crime of rape and murder of two teenage girls.

Forensic examination of the DNA of semen found in vaginal swabs from both deceased girls lead to the conclusion that both the girls were killed by the same person. This had been possible because of the pioneering work in the field of

Forensic Science done by Sir Alec Jaffrey. He developed a new technique of DNA profiling that is known as "*Restriction Fragment Length Polymorphism".* The technology of the RFLP method was used by *Sir Alec* to determine the variations of tendon repeats or the shape of two or more repeated nucleotides in DNA sequence. This process was called DNA Fingerprinting. The method of RFLP was time taking. Subsequently, the *Polymerase Chain Reaction* (PCR) method of DNA profiling was invented in 1983 by Kary Mullis, which proved more sensitive and accurate in producing results. For the invention of the PCR method of DNA profiling, *Kary Mullis* was awarded the Nobel prize in 1993.

DNA technology was developed by Sir Alec Jaffrey but was not available to Indians because the invented DNA technique was gotten a patent by Alec Jaffrey. Thus, for further experiments, examination and development of the DNA identification technique were prohibited. The examination invented by Alec Jaffrey was not allowed for other further experimentations. In India, the pioneering work of Dr Lalji Singh has a great contribution to the development of DNA technology. Dr Lalji Singh invented the procedure called the *"Banded Kraita method"* hereinafter referred to as the BKM probe. Dr Lalji Singh was the director of CFSL Hyderabad. He had been a PhD research Scholar at BHU. His research was on the sex determination of sneaks. He discovered that female sneak has XX and male sneak have XY chromosomes like human beings. Dr Singh's BKM probe was capable to apply Forensic identification of the individual in criminal investigations which is tested and dependable, in fact with greater accuracy and authenticity than Alec Jaffrey's DNA probe. Dr Lalji Singh successfully claimed that his BKM identification technology would be successfully applied in India for the forensic investigation of individuals.

DNA is the blueprint of the human organism after birth. The formation of the DNA chain is made of nucleotide which is the small molecule or the building block of DNA. These building blocks of DNA are threaded together in different arrangements. Such arrangement of the molecules forms a code of a certain message. That message sequences are called *genes.* DNA profiling is the branch of genetic science. Genetic science is the study of the foundation of the hereditary system and its variation. The word hereditary means *like begets like.* That means that the kids mostly resemble the attributes of their biological parents. A certain disease is descended from generations

of families mainly because they are associated with the gene of or are a genetic disease. Forensic DNA profiling can fill the gap between the traditional method of investigation with the modern method of investigation, especially in complex crimes.

In the case of investigation through forensic DNA of criminal, there are three possible consequences which may happen viz.

First: inclusion (when the DNA sample of the suspects matched with the DNA sample found at a crime scene)

Secondly: Exclusion (when the DNA profile of an individual doesn't match with the DNA sample found at the crime scene).

Thirdly: is Inconclusion (this situation occurs where evidence is not sufficient either to include or exclude the suspect).

In admitting a forensic DNA profiling evidence court works upon the *principle of exchange* which was propounded by *Dr Edmond Locard*, the exchange principle implies that the offender must bring something to the crime scene and leave with something at the place of the crime and both things can be utilized as forensic evidence against the criminal. This principle is also known as that *"every contact will leave a trace".*

Chapter III. Forensic DNA Profiling in Criminal Investigation: An International Analysis' is focused on the International legal framework of major countries of the world. The legal system of the U.S.A keeps opened its arm to admit novel Scientific evidence since the Frey ruling, which requires that the scientific examination and principle must be recognized by the concerned scientific community. The fundamental principle and its procedure of examination must be generally accepted by the scientific community and produced as evidence. The New York court said the DNA profiling model is widely recognized by experts in genetics and other related sciences. Even though forensic DNA typing is widely established and generally trustworthy, the method used in this instance was so faulty that any proof of a match was deemed inadmissible. The result of DNA evidence suggests exclusion of the accused is more presumptively admissible than its evidence of exclusion.

The court admits DNA evidence if, the technic of forensic DNA identification must be generally acceptable in the scientific community, there must be a pre-trial

hearing to determine whether the laboratory applying the method and procedure of DNA examination is as per the scientific standard. Whether the laboratory is producing reliable results of DNA analysis. The Supreme Court of the United State has rejected the standards of admissibility of Expert testimony on Scientific evidence proposed in Frye and Frye-plus. Under that The Daubert standard it is sin-qua-non for admissibility of expert testimony on scientific evidence that an "independent judicial enquiry of reliability" is required rather than "general acceptance" among the scientific community. The Daubert test is designed, among other things, to put a stop to the "war of the experts."

The American States are varying on the admissibility standard of scientific DNA evidence, the majority of states are following the Frey Standard of admissibility while others use the Daubert rule of standard in admitting DNA or other scientific evidence.

The DNA analysis Blacklock Elimination Act, 2000 is the most important legislation in the USA for Forensic evidence in criminal investigations. Sec.2 authorise the Attorney General to grant permission to eligible states to carry on DNA examination for criminal investigation. Under this law, the Federal Bureau of Investigation (FBI) shall have the power to lay down and maintain the quality standard assurance and standard of forensic science laboratories. Sec. Sec.3 of the Act, says about the collection, storage, and use of forensic DNA technology for the identification of criminals from certain federal criminals. Sec. 10 of the DNA Analysis Backlog Elimination Act, 2000. says for the standard to guarantee the safety of the right to privacy of every individual and for that end, it permits disclosure of DNA information only for some specified purposes under Violent Crime Control and Law Enforcement Act 1994.

Combined DNA Index System herein referred to as CODIS is an action plan of the US investigating agency known as the Federal Bureau of Investigation hereinafter referred to as FBI. This program is to support criminal justice through DNA Profiling and database. Further CODIS is a software of the FBI, to store and run these databases. The National DNA Index System in the USA is part of CODIS, a National Institution that comprises the DNA Profiles submitted by Federal, individual states, and forensic laboratories participating at the local level. Further, the Justice for

All Act, 2004 was enacted to provide an examination of DNA profiling evidence for judging post-conviction innocent accused so that they can be exonerated from the peril of injustice.

The court of the United Kingdom ruled in favour of DNA profiling. The court held that legislation convincing of taking and preserving the fingerprints, DNA profiles, and bodily samples is legal, and it cannot be said to be violative of Art. 8 and 14 of the European Convention of Human Rights.

The Law in Canada is inspired by the US and UK models of criminal investigation with forensic DNA evidence. The "Criminal Code and the Young Offenders (forensic DNA analysis) Act, 1995 was passed to provide a mechanism to make applicable forensic DNA profiling for the criminal investigation in criminal cases. This law allows a court to issue a warrant for the collection of DNA evidence from suspects in criminal investigations under this measure. For the first time in Canada's DNA strategy, DNA evidence will be admissible in criminal cases under a new legal framework. The Act 1995 authorises the court to power to collect the biological material for DNA analysis from accused of serious offences like murder, rape, robbery etc.

The DNA Data Bank of the USA the Royal Canadian Mounted Police (RCMP) in Ottawa looks after Canada's National DNA Data Bank. It was established in the year 2000, the bank has multiple indexes like the Convicted Offenders Index having 304,477 profiles Crime Scene Index has 103,789 profiles and the Crime Scene to Offender linking Index 33,815 profiles[35] under the DNA Identification Act 1998.

Chapter IV. on Forensic DNA Profiling in Criminal Investigation: A National Legal Framework of India, analyses in detail the forensic DNA evidence in the Indian Court is admissible or is being admitted under section 45 of the Indian Evidence Act 1872. The very first time the issue of admissibility came before the court of Chief Judicial Magistrate, Distt. of Thallassery Kerala, in the case of *Manoj v. Kunhiraman*[36] the Court of CJM., Tellicherry, Kerala in and the Court accepted this test to decide the paternity and it was held admissible in evidence under Section 45,

[35] *available at:* https://ottawacitizen.com/news/local-news/a-primer-on-dna-forensics/
[36] Case No. M.C 17 OF 1988.

Indian Evidence Act. In the same case, Dr Lalji Singh appeared as a forensic expert, and the Court observed that when the opinions of fingerprint experts and chemical experts, and ballistic experts can be admissible why the evidence of DNA experts be not admissible in evidence and in an appeal against the order the High Court upheld the decision of lower Court.

It is said that scientific advancement with DNA as well as RNA tests was not even in contemplation of the Legislature. The result of the genuine DNA test is said to be scientifically accurate. The power to collect the biological sample for DNA profiling is provided under sec. 53 and 53A of Cr. PC under the head medical examination at the request of police and medical examination of accused of rape. As long as a police officer has a valid basis to ask a doctor to examine an accused person, Section 53 of Cr PC does not preclude the courts from giving a police officer a directive to obtain DNA samples from an accused person for further investigation under Section 173 (8) of Cr PC.

The magistrate exercising jurisdiction to trail a case would have the authority to order the collection and analysis of biological material for extracting the DNA profile of the suspected or accused individual. Thus, the provision of sections 53 and 53A has specifically allowed for the inclusion of DNA profiling under the concept of medical examination."

Chapter V. DNA Profiling in Criminal Investigation and Right to Privacy in India analyses in detail the concept of the right to privacy and discusses how the privacy and DNA technology would be understood as per the ruling of the Supreme Court, and further discusses that giving of biological sample by an accused of an offence for medical examination which includes DNA analysis would not cover under the term "to be a witness of against himself" within article 20(3) of the constitution. Thus, the collection of blood or other samples from an accused of an offence even for DNA examination would not be understood as compelling him to be a witness against himself. Because such a sample by itself is innocuous, consequently the sample collection, doesn't amount to the collection of information. share any information that may be within the personal knowledge of the accused person. There is no constitutionality issue of the power of police to a collection of samples for DNA examination under sec. 53 and 53A

The scientific report of an expert like a "chemical examination report" can be used as a piece of evidence for enquiry and trial by a criminal court but in every case, the criminal court shall have the power or discretion to call the scientific expert to for examination of such expert to the court's satisfaction in any case wherein the court things fit to do so under Sec. 293 Cr. PC. Thus, the report on DNA profiling by government scientific experts, be it the Assistant Director or the Deputy Director or the Director of any Forensic Science Laboratory whether of State-owned CFSL or The Central government's CFSL, shall be a substantive piece of evidence.

The supreme court has a strong observation about the capability of DNA Forensic evidence that "a dead man tells the tale when it is in the hands of a forensic science expert" the DNA profiling reliable and accurate. It produces authentic forensic evidence. DNA examination is innovative to the degree, that even if a blood sample or biological material would be disintegrated badly the forensic DNA profile leftovers the same unchanging excluding the situation where the blood is burnt by the fire.

DNA profiling was critical in proving the guilt of Pakistani Militant Ajmal Kasab, a member of Lashkar-e-Taiba, a terrorist group, The Kasab was indicted and convicted for the terrorist attack in Mumbai killing 72 people when his DNA profile was compared to the DNA profile of biological material taken from the hotel mattress where he was staying. He has been sentenced to death a total of five times.

In Nirbhaya Rape and Murder Case, forensic DNA profiling played a decisive role in determining the guilt of all four accused. DNA of semen found in the body of the prosecutrix was compared with the DNA found at the crime scene and from all accused. Dr B.K. Mahapatra concluded at the samples collected were authentic and reasonably established their identities beyond a reasonable doubt and convicted all the accused.

A negative presumption against prosecution if forensic testing is not conducted. Section 114(g) of the Indian Evidence Act, 1872 says that if the prosecution withholds the best evidence from the court because it is favourable to the prosecution's case, the courts will take an unfavourable view. The High Court of Uttarakhand has issued a list of questions to the trial court to ensure that the DNA result is accurate Expert witness cross-examination When cross-examination fails to

ask a witness a question that may have elicited an answer, "The accuracy and legality of the aforementioned problem cannot be addressed later on is important to note."

DNA is stable evidence though the validity of forensic samples collected from the victim and accused may be affected by time duration, chemical variables, and environmental factors. So, the collection of samples and analysis of DNA profiles must be completed. The accused may also plead guilty by refusing to submit a DNA sample for analysis and comparison. Equity necessitates that an accused must have the right to request DNA and other forensic testing to establish his innocence, even though courts are not giving such arguments any weight. The defence counsel may also apply the DNA report's inconclusiveness to their advantage. Medical examinations for sexual offences might be utilized by law enforcement to get a DNA sample from an alleged victim.

The Indian parliament has enacted the Criminal Procedure (Identification) Act, 2022. to empower the police to take measurements of any person convicted for any offence or any other person for investigation and identification of the criminal. This act authorises keeping the record of such measurements for incidental purposes for 75 years. Sec. 3 of the Act a person shall allow their measurements to be taken by police or prison officer. Only the person arrested for an offence punishable with imprisonment of less than 7 years may not be obliged to allow to give his biological sample except when he is accused of a crime against women or children.

The NCRB shall have the power to collect, store or preserve and destroy, process and share and disseminate the record of measurement in a manner prescribed by the central government. Any such agency as may be notified by the Union or the state government shall have the power to collect and preserve and share such records The magistrate shall have the power to order the collection of measurements from any person to his satisfaction. The resistance by such person from taking measurement shall be an offence under sec. 186 of IPC. The central or the state government shall have the power to make rules for this Act. The police officer shall have the authority to collect the measurements means a police officer is not below the rank of "Head Constable". The "measurement" which may be collected from a person includes biological samples, footprints, finger impressions, retina and iris-scan, and all the

examinations as provided under sec. 53 or sec. 53A of the "Code of Criminal Procedure 1973."

The Act further provides that in case the record of measurement is collected from a person who is neither previously convicted for any imprisonment and is acquitted, released or discharged by the court or pre-trial released. All records of measurement if collected from such person shall be destroyed immediately. Here it is noticeable that sec. 53 and 53A of the Code of Criminal Procedure provide for DNA Profiling of examination under clause 54A(2)(iv). Thus, the Act is authorised to collection of biological material from the person for DNA profiling and identification of criminals based on DNA comparison and storage of such profiles for 75 years. The act grants the authority to the magistrate to order the collection of biological material if he is satisfied to do so. Here one more thing is noticeable, that the police officer up to the rank of head Constable shall have the power to collect biological material for DNA profiling without the authority of a magistrate. This Act would be a game-changer in criminal justice administration. This Act would empower the investigation authorities to exhaust the scientific mechanism, scientific evidence, tools and technologies for criminal investigation and identification of criminals be it biometric identification, forensic identification etc.

The purpose of the act is to utilize every scientific method to convict the real culprit, thus, delivery of justice to the victim of crime and maintenance of law and order in society with effectiveness. The provisions for collection of measurements for examination of DNA test will only be appropriate when the law would be made which will provide for DNA regulatory Board and DNA Data Bank, where the Board shall be required for regulation and standardisation of collection, storage or preserve, destroy, process and share and disseminate the record of measurement. The Board recommended constituting the Bill 2019, a balanced body to regulate the use and application of DNA technology. It was comprising all stockholders to have a perfect Regulatory body.

Bill 2019 was provided for DNA Databank which is very important for the success of DNA technology in a criminal investigation. We can take the example of CODIS of the USA and NDNAD of the UK, these DNA databanks which is proven to be very crucial for the collection and storage of DNA profiles of a variety of indexes.

The legal tressure in India on the utilization of forensic DNA technology in criminal investigation is not satisfactory. Except for some amendments in procedure law viz. Code of Criminal Procedures and Evidence law, there is no specific legal mechanism to regulate the use and application of the technology. The collection analysing and storage of DNA samples is not legally backed by any special law or statute of parliament. There is no DNA data Bank in the line of CODIS of the USA and Universal DNA Bank of the UK further there are no data protection laws in India. Just the apex court in India declared privacy of the individual is a fundamental right and an integral part of the right to life and personal liberty under article 21. Unfortunately, still, there is no specific legislation to regulate the concern for individual privacy. There should be specific legislation in the line of Justice for all Act 2004, DNA Analysis Backlog Elimination Act, 2000 of USA to regulate the collection use and analysis of DNA samples of the accused of a serious offence. The central government must initiate establishing a DNA data bank in the line of CODIS at the national and state level to retain the DNA profile of accused and convicted offenders of heinous crimes, which would help speedily identify the culprit. There should be a cooperative and collaborative effort between USA India and the UK to strengthen forensic DNA technology in a mutual way to make the justice delivery system more efficient and technically stronger. Because it pertains to criminal law, forensics and other types of expert opinion must be addressed in a different context. A thorough approach. The investigation agency's careless attitude toward Expert opinion-seeking must be discouraged. Legislative and judicial bodies must bring up mechanisms to encourage investigators to make better use of forensic inputs Section 156(3) Cr PC gives the magistrate the authority to keep an eye on but he is unable to carry out his inquiry. Total India laws are needed to be put into practice effectively. A zero-tolerance policy must be instituted to be compensated for a sloppy and careless approach to justice Long overdue is an increase in the number of forensic investigators and equipment.

Chapter VI DNA Profiling and Forensic Science Laboratories in India is on the structure and working conditions of Forensic Science Laboratories in India. The use of Forensic Science in India was witnessed since the “Eureka” of Archimedes. In the modern era, If India is willing to the effective fight against rape like heinous offences. It should strengthen and modernize its forensic infrastructure. Malimath committee showed worry on huge pendency along with less conviction ratio of

criminal case. The recommendation of the committee is must to implement. The better regulatory model of FSL's like PPP model and special initiative on FSL by government is need of hours. The testing standards requires assurance of international standard for FSL to better dependability on forensic investigation it must be to adhere. We must look at the gold standard to guide FSL testing standard of accreditation and regulation of DNA testing. There should be a process of blind proficiency examination for forensic expert. Wherein the situation, the forensic experts must be completely unaware of the fact that there is any assessment going on whatever they are carrying out forensic examination. the outcomes of their test would be measured for the purpose of deciding the standard of correctness, prejudices, and error fraction, thereafter this reassessed result of their work will be shared with the forensic expert's employees of the laboratory to assist them in improving their performance.

Chapter VII. Forensic DNA Profiling in Criminal Investigation: An Empirical Analysis, wherein Law scholars support the reliability factor of DNA technology for criminal investigations. the survey of Forensic experts shows that there are two kinds of experts viz., lab experts and forensic experts deployed in the field. The majority of them are lab experts. The Forensic expert law scholars and police officers all were of the view that there is a hard need for a forensic DNA databank for the availability of a DNA database investigating repeated offences or offences after the storage of DNA in the databank. The experts were of the view that DNA evidence is reliable, but authority like the DNA Regulatory Board maintains and standardises the technology and laboratory functioning. The survey found that every respondent was feeling that there should be a special law on DNA Technology and its applicability. There is a lack of sufficient laboratory infrastructure and forensic brain force to work as per the need of the hour. The report of a DNA test takes time approximately 3 to 4 days. This much delay in DNA analysis is because of a lack of required infrastructure, a law requiring the number of forensic science experts in FSL Lucknow and the lack of a "DNA Analysis Kit" for forensic Science Experts.

Magistrate have authority to admit any report of the chemical examiner under Sec. 293 CrPC authorises but in doing so he has the discretion to admit such report of a forensic expert on DNA profiling, He may or may not admit the report of DNA profiling as scientific evidence. Further, the court has the discretion to call a forensic expert upon the report and cross-examine him. The practice is that experts are

generally called to cross-examination on the report under sec. 293 Cr. PC the report which generally meets the irrelevant questioning and answers from lawyers and judges despite they don't possess proficiency in forensic science. This is a major hurdle in the implementation of DNA technology for crime investigation in India.

DNA technology directly impacts criminal justice administration positively. The development of criminal justice investigation and the criminal justice system depends upon the nation's forensic DNA ability and capability. Forensic DNA evidence can play the role of strong and unbiased crucial evidence that will ensure a scientifically fair and just investigation and the trial of any accused person. It requires the collective effort of bar-bench and investigation agencies with a forensic investigating tool for better criminal justice administration. Like court found incapable to order a DNA test for paternity determination in the absence of a specific provision under Art. 112 of Evidence Act. It should be inserted as soon as possible.

The CFSL infrastructure is required to be made rich and it must be engaged as a supplementary institution of investigation agencies like CBI, NIA and CIA. The Bar Council of India is required to introduce the core Forensic Science useful in criminal investigation to mould forensic expert Advocates and Judges. There is a need to provide special training and education to judges and advocates so that they can be skilled in the minutes of DNA reports while producing them as evidence in court. Taking of DNA sample isn't an encroachment on right to protection against the self-incriminatory statement, rather it is the enforcement of victims' right to speedy justice and the accused's right to a scientifically fair trial. Policing is very weak in India as the researcher found in the survey. Though the awareness about DNA technology and the authority of law police has the power to collect DNA samples is satisfactory amongst police personnel. But neither any forensic experts at the police station level nor any periodical education and training provided to police on the forensic science-based investigation. The police even don't friendly with the "forensic investigation Kit" which comprises instruments for forensic investigation. Despite such skill and arrangement majority of police have said that they were deployed to collect forensic evidence during the investigation. Police are facing extensive delays in collecting the DNA profiling report from the FSL in India generally Forensic Science Laboratory due to a heavy workload on FSLs.

The forensic DNA profiling tool for criminal identification is the most reliable and important technology in the criminal justice Administration. the survey proved this phenomenon. The DNA evidence plays the role of a dual-edge sword. On one side it helps the court to identify the real culprit scientifically without any mistake and on the other side, it exonerates the wrongfully convicted or accused person. On the basis of above study and conclusion the researcher submits the following suggestions for a better way forward:

SUGGESTION:

1. The law as to the authorization of DNA examination in criminal procedure in India as provided in Sec. 53 and 53A CRPC is not adequate. There is an urgent need of bringing into force a special Legal framework regulating the use and application of DNA profiling in India like the DNA Technology Bill 2019.
2. The existing provision of paternity determination under Sec. 112 Indian Evidence Act should be amended to bring the DNA technology to play a decisive role in determining the maternity, paternity and solving the issue of child swiping.
3. There must be a special police wing with at least two police personnel in each police station having expertise or proficiency in collecting and storing forensic biological samples from the crime scene.
4. The police personnel should be provided compulsory periodical special training and education in the process of investigation based on forensic DNA profiling of criminal identification.
5. The procedure of investigation of forensic evidence is of high importance because any negligence in the field as to the collection of the sample at the crime scene, preservation and conveyance of such sample to laboratory may cause the sample useless. Thus, the accountability of proper collection preservation and conveyance of biological evidence for DNA analysis must be put on the inspector of police leading the investigation.
6. The police should be accommodated with “live streaming body cameras” while deployed for investigation so that a fair record of evidence collected from the crime scene would be ensured.

7. There should be a clear bifurcation of the police investigation wing of police personnel from that of the political management wing and law and order maintaining wing because the two categories of force require completely different skills and proficiency.

8. There is a need for a strong legal framework providing for prompt, active, coordinating and collaborating action amongst the investigation officers, forensic experts and registered medical practitioners in conducting DNA based investigations.

9. As soon as possible the law must be brought into force establishing DNA Databank in the line of the Combined DNA Index System of the USA and National DNA Databank of the United Kingdom it would be a check on the habitual offenders and easy identification of criminal by the match of DNA profile of the person whose genetic data is stored in such databank with that found in the crime scene.

10. DNA Profiling Database in DNA Bank must be secured with modern security software technology to prevent it from being misused and ensure the privacy of individuals like *Blockchain protocol* which is being used in the Bitcoin revolution.

11. It is highly required in India that DNA regulatory authorities such as the DNA Regulatory board as were provided in the DNA technology Bill 2019 must be created with the power and authority as the FBI of the USA provided to perform in a matter of forensic investigation. Such DNA regulatory authority is required to maintain the Forensic Science Laboratory standards, its accreditations and the maintenance of the quality assurance in FSLs.

12. The DNA profiling test should be done in the Forensic Science Laboratories which are accredited and approved by the government to maintain the uniformity of international standards of forensic evidence.

13. The Forensic Science Laboratories should be made infrastructure rich; they must be provided with proper tools and techniques; forensic science facilities and experts should be made available all time.

14. There should be a district-wise FSL facility made available in every state of India to ensure a prompt and speedy scientific investigation of any crime.

15. The Forensic Science Laboratories should be made available all necessary chemicals and instruments in advance called DNA analysis kits like "Viral DNA extraction kit"[37] which are expensive and patented in the USA. In case of unavailability of such kit the report of DNA analysis used to delay.

16. The state initiative is the need of the hour for capability building like *'The Sakhi Suraksha lab* of Chandigarh and PPP model-based *Truth Forensic Science Laboratory* to speed up a criminal investigation based on forensic DNA evidence in cognizable offences.

17. An independent agency in India free from political influence is required with the power to intervene and conduct an examination of any report of DNA analysis to check the trustworthiness and correctness prepared by the forensic expert to be present as evidence in a court of law. The forensic lab its administration, police investigating the case and medical practitioner should be directly responsible for such an independent body.

18. As the survey has shown that the awareness amongst judicial officers is not satisfactory There should be a compulsory periodical interactive session between judicial officials and forensic experts on the current trend of forensic DNA evidence. Judicial officers should be made aware of the method of Forensic DNA profiling and the positive or negative aspect which can lead to a just decision.

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[37] *available at*: https://www.labfriend.co.in/viral-dna-extraction-kit-100-preps(Last visited on 23rd February 2021).