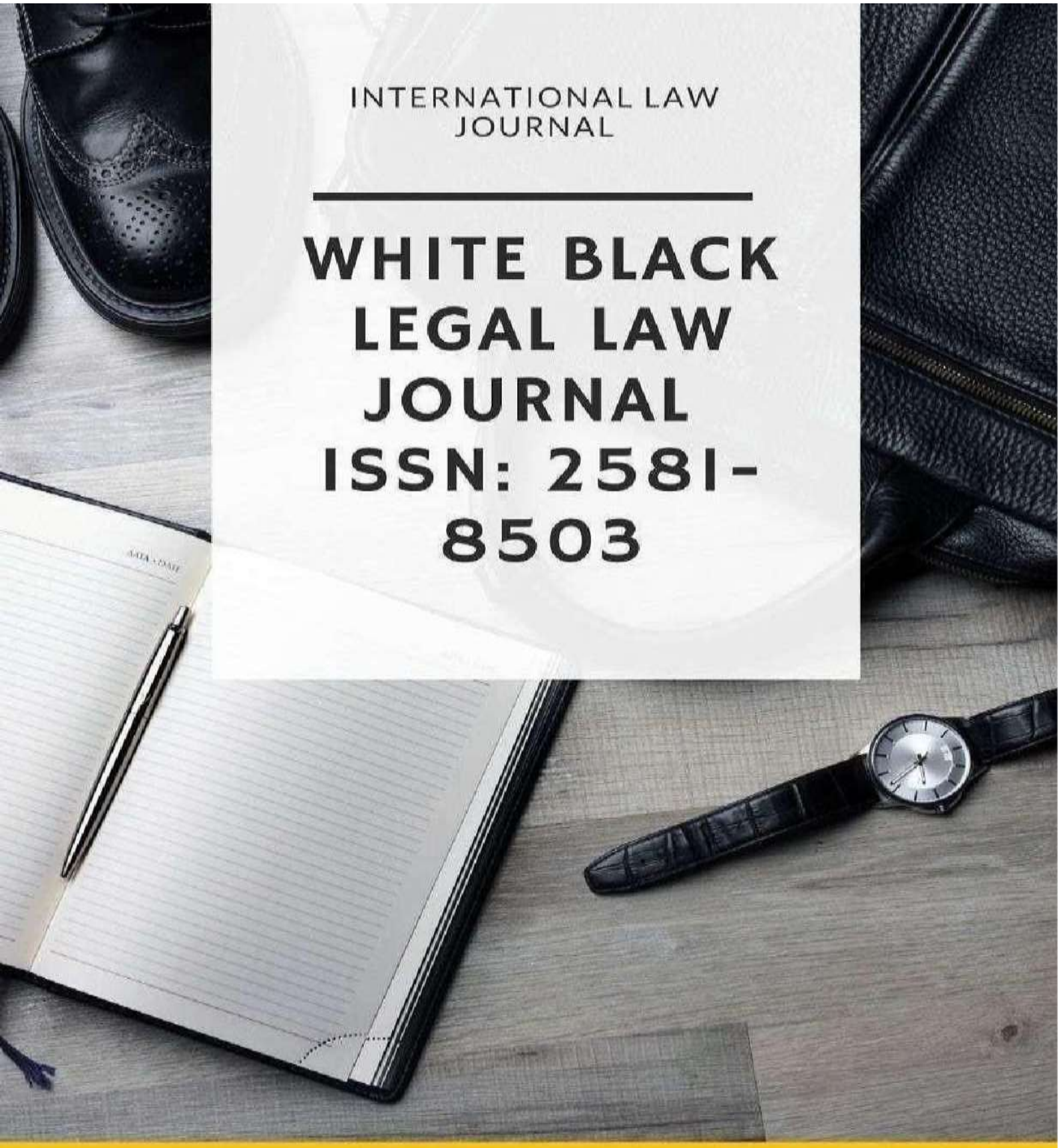

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ABOUT US

WHITE BLACK LEGAL is an open access, peer-reviewed and refereed journal provide dedicated to express views on topical legal issues, thereby generating a cross current of ideas on emerging matters. This platform shall also ignite the initiative and desire of young law students to contribute in the field of law. The erudite response of legal luminaries shall be solicited to enable readers to explore challenges that lie before law makers, lawyers and the society at large, in the event of the ever changing social, economic and technological scenario.

With this thought, we hereby present to you

DNA FINGERPRINTING TECHNOLOGY: A SUCCINCT STUDY

AUTHORED BY - NIRAJ SHARMA

OBJECTIVES

1) To build conceptual framework of the study.
2) To examine the concept and laws related to DNA fingerprinting in India and other countries.
3) To examine the Challenges in accepting DNA fingerprinting reports in different matters.

SCOPE OF THE STUDY

The scope of the study is confined to know the basics of DNA fingerprinting and its application in India and other countries. Basically, it confines to only the overviews of the laws dealing with DNA testing. The study deals with different laws present in different countries. The various drawbacks of using the same technology are also covered in my study.

HYPOTHESIS

The laws dealing with DNA and its use in India and other countries are not uniform. In India, laws related to DNA is not complete in itself.

RESEARCH METHODOLOGY

Research in this work has been done having relied mainly on "Doctrinal Method" of research. The methodology adopted for the present research is doctrinal, analytical and descriptive. The researcher mainly depended upon the primary sources and secondary sources like books, articles, websites, opinion of research scholars and experts in the respective field. Internet provided major contributions of most relevant and latest information on the web which has helped the researcher to explore the subjects through various dimensions.

ABSTRACT

Almost every cell in our body contains our DNA. On average, about 99.9 per cent of the DNA between two humans is the same. DNA (Deoxyribonucleic Acid) is the primary hereditary material in a human body. The DNA Fingerprinting technology is one of the foremost and most reliable technologies used in USA and UK in identifying individual culprits through their respective unique DNA patterns. The main types of DNA fingerprinting methods in use at this time are RFLP, PGR, Amp FLP and STR. There are various benefits in using DNA fingerprinting such as certainty, convenience and many more. Various provisions deal with the issue of DNA fingerprinting such as Cr.P.C., Constitution, Evidence, etc. The DNA Technology (Uses and application) Bill, 2019 has been made with a view to provide legal framework to use of DNA in civil and criminal matters.

INTRODUCTION

Almost every cell in our body contains our DNA. On average, about 99.9 per cent of the DNA between two humans is the same. The remaining percentage is what makes us unique (unless you are an identical twin!).

It might sound like a small amount, it means that there are around three million base pairs that are different between two people. These differences can be compared and used to help distinguish you from someone else.

Minisatellites are short sequences (10-60 base pairs long) of repetitive DNA that show greater variation from one person to the next than other parts of the genome?. This variation is exhibited in the number of repeated units or 'stutters' in the minisatellite sequence. The first minisatellite was discovered in 1980.

DNA: An Overview

DNA (Deoxyribonucleic Acid) is the primary hereditary material in a human body. The Human DNA has a double helix structure. Most of the DNA is found in Nucleus of the cell called the nuclear DNA, and some are found in mitochondria called the mitochondrial DNA (mtDNA). It complexes with proteins to form chromosomes which contain our genes and all genetic information.

The DNA Fingerprinting technology is one of the foremost and most reliable technologies used in USA and UK in identifying individual culprits through their respective unique DNA patterns.

In 1984, **Sir Alec Jeffreys**, of UK discovered that no two people could have the same DNA sequence. Although more than 99% of the DNA is the same in all humans, there are some particular strands that are unique between two individuals having the same sequence. Sir Jeffreys was the first person to discover this. This led to the birth of DNA Fingerprinting. The potential of DNA Fingerprinting in the investigation of crimes was quickly realized. In 1986, this method to solve the rape and murder mystery of a teenage girl Dawn Ashworth near Leicester. The suspect Richard Buckland was exonerated, and the real criminal Colin Pitchfork was found guilty. It was the first case in which DNA technology was used.[1]

Procedure

1) The first step of DNA fingerprinting was to extract DNA from a sample of human material, usually blood.
2) Molecular 'scissors', called restriction enzymes?, were used to cut the DNA. This resulted in thousands of pieces of DNA with a variety of different lengths.
3) These pieces of DNA were then separated according to size by a process called gel electrophoresis?:
   a) The DNA was loaded into wells at one end of a porous gel, which acted a bit like a sieve.
   b) An electric current was applied which pulled the negatively-charged DNA through the gel.
   c) The shorter pieces of DNA moved through the gel easiest and therefore fastest. It is more difficult for the longer pieces of DNA to move through the gel so they travelled slower.

      As a result, by the time the electric current was switched off, the DNA pieces had been separated in order of size. The smallest DNA molecules were furthest away from where the original sample was loaded on to the gel.
4) Once the DNA had been sorted, the pieces of DNA were transferred or 'blotted' out of the fragile gel on to a robust piece of nylon membrane and then 'unzipped' to produce single strands of DNA.
5) Next the nylon membrane was incubated with radioactive probes.
   a) Probes are small fragments of minisatellite DNA tagged with radioactive phosphorous.

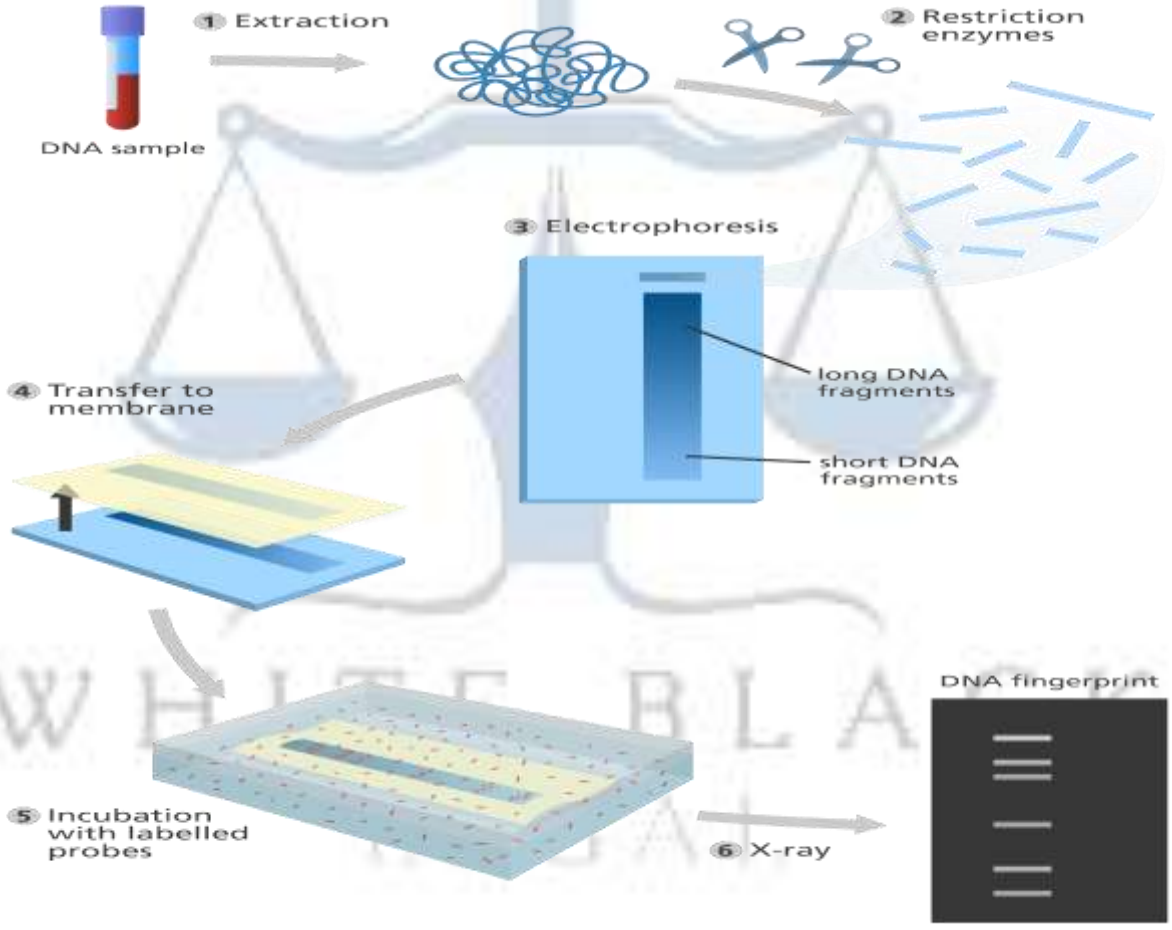
[1] J.P.Modi, Medical Jurisprudence, Lexis Nexis,24th edn.

b) The probes only attach to the pieces of DNA that they are complementary to – in this case they attach to the minisatellites in the genome.

6) The minisatellites that the probes have attached to were then visualised by exposing the nylon membrane to X-ray film.

When exposed to radioactivity a pattern of more than 30 dark bands appeared on the film where the labelled DNA was. This pattern was the DNA fingerprint.

To compare two or more different DNA fingerprints the different DNA samples were run side-by-side on the same electrophoresis gel. [2]



DNA Fingerprinting Technique

The main types of DNA fingerprinting methods in use at this time are RFLP, PGR, Amp FLP and STR.

(A) RFLP: Restriction fragment length polymorphism (RFLP) analyzes the length of the

[2] J.P.Modi, Medical Jurisprudence, 24th edn

strands of the DNA molecules with repeating base pair patterns. DNA molecules are long strands found tightly wound in chromosomes which are contained in the nucleus of each human cell.

With each DNA strand are numbers of genes that determine the particular characteristics of an individual. While about 5% of the gene compositions on DNA contain this type of genetic information, the other 95% do not. However, of the 95%, these non-coding genes contain identifiable repetitive sequences of base pairs, which are known as VNTR(ariable number tandem repeat).

The restriction fragment length polymorphism analysis is used to detect the repeated sequences by determining a specific pattern to the VNTR, which becomes the person's DNA fingerprint. Inclusions are isolation of DNA, digestion of DNA by restriction endonucleases, separation of DNA fragments by electrophoresis, transferring (blotting) of separated DNA fragments to synthetic membranes.[3]

(b) PCR:

PGR (Polymerase chain reaction) PGR analysis amplifies the DNA molecules using a smaller sample. The PGR was found to be useful in identifying DNA fingerprints in criminal matters on the forensic front. In paternity tests, it requires less amounts of DNA because it makes identical copies of the DNA sample. The PGR analysis amplified isolated regions on the strands of the DNA under examination, therefore, it was not as discriminating as the RFLP.

(c) AmpFLP:

AmpFLP (Amplified fragment length polymorphism) AmpFLP came into vogue in the 90's and is still popular in the smaller countries involved in the process of DNA fingerprinting. It is relatively less complicated operation and has the cost-effectiveness of the procedure. By using the PGR analysis to amplify the minisatellite loci of the human cell, this method proved quicker in recovery than the RFLP.[4]

(D) STR:

The system most widely form of DNA fingerprinting STR is the (Short tandem repeat) methodology for extracting DNA. This system is based on the features of PGR, as it utilizes

[3] https://link.springer.com/chapter/10.1007/978-981-13-1583-1_2 last accessed on June 16, 2025
[4] https://geneticeducation.co.in/dna-fingerprinting-definition-steps-methods-and-applications/ last accessed on June 19, 2025

specific areas that have short sequential repeat DNA.

The STR analyzes how many times base pairs repeat themselves on a particular location on a strand of DNA. The DNA comparisons can match the possibilities into an almost endless range; therefore, it is the big advantage in this method. [5]

Benefits of DNA fingerprinting technology

1. **DNA fingerprinting provides another layer of forensic evidence**.

   A pair of gloves might be able to stop fingerprints from being left behind at a crime scene. DNA evidence is much more difficult to prevent. People shed skin flakes and hair follicles all the time. A sneeze releases saliva and body fluids that contain DNA traces. Even coughing can cause DNA traces to be left behind.

2. **It offers a greater level of certainty than standard fingerprinting.**

   No two people are believed to have the exact same fingerprints, just like no two people are believed to have the exact same DNA. Although this process is fairly accurate, it is not as accurate as DNA fingerprinting. According to the National Institutes of Standards and Technology, fingerprint comparisons are accurate 98.6% of the time on a single finger. DNA fingerprinting is accurate 99.9% of the time.

3. **DNA fingerprinting is unobtrusive.**

   Traditional fingerprinting requires dark ink to be placed on each finger. That finger is then rolled onto a card. Some fingerprinting may require palm prints as well. In comparison, DNA fingerprinting requires a simple cheek swab together the information that is required. Some people have the idea that for a DNA test to be accurate, a blood test must be performed. That is simply not true. DNA fingerprinting is just as easy as traditional fingerprinting when information must be obtained.

4. **The evidence collected from DNA fingerprinting can be stored indefinitely.**

   DNA fingerprinting creates a specific genetic profile that can identify an individual. These profiles can be stored in databases for an indefinite period. Because this information is transformed into data points, it can be communicated quickly over the internet. Internal information can be communicated quickly over an ethernet.

5. **DNA fingerprints have more than a criminal justice emphasis.**

   There are many ways that we can use DNA fingerprinting to benefit our personal lives. People are using their DNA profiles to determine their ancestry and heritage. This

[5] DNA fingerprinting, Lectures by Neela Bakore

information can be used to determine biological parentage. We can even use it to identify people who may be at-risk of suffering from certain genetic diseases or genetically-related cancers. Although we often look at DNA fingerprinting as a way to identify criminal suspects, it has a variety of uses that we are continuing to develop.[6]

6. **It could become the foundation of genetic treatments.**

   Hereditary diseases have a genetic component to them. DNA fingerprinting can already be used to identify people with specific diseases. Infant screenings can catch PKU, for example, before it becomes a life-threatening problem. Infants with PKU can then be placed on a restrictive diet to ensure they live a happy and fulfilling life. With this information, we can also develop new genetic treatments that can restore DNA, or alter it, to help people be able to recover from what may be unrecoverable right now.[7]

Present legal conundrum around DNA profiling in India

In India, the legal position of DNA fingerprinting has mostly remained dicey, surviving among two opposite poles of attaining the truth or respecting individual privacy. The Constitution under Article 51A(h) and (j) casts duty upon the citizens to develop scientific temper, humanism and the spirit of Inquiry and reform to strive towards excellence in individual and collective activity and thereby the parliament can legitimately undertake and promote technical and scientific methods to expedite the criminal justice system as provided under the union list. Section 9 of the Indian evidence Act, 1872 act deals with 'facts necessary to explain or introduce a fact in issue or relevant fact'. Further, if the evidence of an expert is relevant under section 45, the ground on which such opinion is derived is also relevant under section 51. Section 46 deals with facts bearing upon opinions of experts. The opinion of an expert based on the DNA profiling is also relevant on the same analogy. However, the question that is actually perplexing is that whether a DNA analysis can be legitimately directed or not. In special cases, such as Rape, the Cr.P.C. vide Section 53-A has provided that an accused of rape can be examined by a medical practitioner, which may include the collection of bodily substances from the accused for DNA fingerprinting.

Nemo Debet Proderese Ipsum[8]

The issue of DNA fingerprinting cannot be discussed without the angle of self incrimination

[6] https://allaboutdnafingerprinting.weebly.com/advantages-and-disadvantages.html
[7] DNA fingerprinting, Lectures by Neela Bakore
[8] https://definitions.uslegal.com/n/nemo-tenetur-se-ipsum-prodere/ last accessed on JUNE 15,2025

under Article 20 (3) and the question of violation of private space of an individual and its consequences thereof under Article 21 of the Constitution of India. The various judicial pronouncements under these articles have hung around like a pendulum resulting in widespread uncertainty regarding the legal stance of the DNA technology. Let us take into consideration, a few of the Landmark judgements that have touched upon the topic of the interplay between the DNA fingerprinting technology and the right against self incrimination and of privacy.[9]

The court established that, giving of fingerprint or collection of any other evidence of 'private nature' does not essentially attract the maxim **nemo debet proderese ipsum**, i.e., no one can be required to be his own betrayer; as the latter would mean that a person has produced knowledge through his own volition that would establish his guilt, either by way of undue influence, coercion or threat or not. When there is apparent conflict between the Right to Privacy of a person not to submit himself forcibly to medical examination and duty of the court to reach the truth, the court must exercise its discretion only after balancing the interests of the parties and on due consideration whether for a just decision in the matter, DNA test is eminently needed.

In light of the confusing legal position described in aforementioned paragraphs, it was necessary to bring in a special dedicated legislation that governs the uses and Application of DNA Technology in India.

The DNA Technology (Uses and application) Bill, 2019 and its highlights

The Bill is aimed at regulating DNA technology usage for establishing the identity of persons in respect of matters which are laid down in the IPC, and also, offences under other laws such as the Immoral Traffic (Prevention) Act 1956, the Medical termination of Pregnancy Act, 1971, the Protection of Civil Rights Act, 1955 and the Motor Vehicles Act, 1988 and for various civil matters such as migration, parentage disputes, transplantation of human organs etc.

The Bill when finalized as an Act, will set up a DNA Profiling Board. The Board, with 12 members, will be the supreme regulatory authority that will grant accreditation to DNA laboratories and lay down guidelines, standards and procedures for their functioning. It will advise central and state governments on “all issues relating to DNA laboratories”. It will also

[9] DNA and its scope, The Scientist

be the sole authority to make recommendations on ethical and human rights, including questions of privacy and issues related to DNA testing.

The members of the Regulatory Board shall consist of experts in the field of biological sciences; member of the National Human Rights Commission; the director-general of the National Investigation Agency(or nominee); the Director of CBI(or nominee); the Director General Police of a state; the Director of the Centre for DNA Fingerprinting and Diagnostics; Director of the National Accreditation Board for Testing and Calibration of Laboratories; Director of the Central Forensic Science Laboratory; Officers not below the rank of Joint Secretary from the Ministry of Law and Justice and Ministry of Science and Technology; and an officer not below the rank of Joint Secretary with knowledge and experience in biological science.

The Bill shall establish a National DNA Data Bank and various Regional DNA Data Banks, with the purpose of maintaining important indicators such as crime scene index, suspects or undertrials index, offenders index, missing persons index and unknown deceased persons index. The DNA laboratories are required to share DNA data so collected during analysis, with the Data Banks.

As a general rule, the samples of DNA can only be collected with the written consent of the individual but for offences with punishment of more than seven years of imprisonment or death, consent is not required. The magistrate may, if he is satisfied that there is sufficient and reasonable cause, may order for taking of bodily substances.

No laboratory shall undertake DNA testing without obtaining accreditation from the Board. The Board may, within a period of ninety days from the receipt of application grant accreditation to such laboratory or renew it, subject to such conditions as it may deem fit and on the occasion On the revocation or suspension of accreditation of the DNA laboratory, the laboratory shall hand over all DNA samples and records relating to DNA testing from its laboratory to such DNA laboratory as may be directed by the Board

The National DNA Data Bank shall, on receiving a written request of a person who is neither an offender nor a suspect or an undertrial, but whose DNA profile is entered in the crime scene index or missing persons' index of the DNA Data Bank, for removal of his DNA profile

therefrom, remove the DNA profile of such person from DNA Data Bank under intimation to the person concerned. The Bill provides for the removal of DNA profiles of suspects on filing of a police report or court order, and of undertrials on the basis of a court order.

The board shall take all necessary steps to ensure that information relating to DNA profiles are protected against access, use or disclosure not permitted under this Act or any regulations made thereunder and that all DNA data, samples and records thereof shall be used only for the purposes of facilitating identification of the person and not for any other purpose

Whoever wilfully discloses such data in any manner to any person or agency not entitled to receive it under this Act shall be punishable with imprisonment for a term which may extend to three years and also with fine which may extend to one lakh rupees; wilfully obtains individually identifiable DNA information from the DNA laboratory which may extend to three years and also with fine which may extend to one lakh rupees; accesses information otherwise than in accordance with the provisions of this Act; knowingly and intentionally, destroys, alters, contaminates or tampers with biological evidence which is required to be preserved under any law for the time being shall be punishable with imprisonment for a term which may extend to five years and also with fine which may extend to two lakh rupees.[10] However, the government withdrew the DNA Technology (Use and Application) Regulation Bill, 2019 from Lok Sabha.

Critical analysis of the Bill

A strand of DNA being a fundamental and the most private element of individual containing determinative biological information about the person, possesses the ability of being grossly misused. With the growth in the technology, and increase in varied applications pose the risk of such information being misused by the investigating agencies. For example. The bill does not specify if samples collected in civil matters will be store in the data banks or not, leading to acute privacy concerns. Also the question whether DNA technology is foolproof, and whether the proposed law adequately addresses the possibility of abuse, is largely unanswered.

There still remains a chance where a wrong match could be generated or some mix up occurs while processing the DNA resulting in flagrant loss to the persons rights and liberties and in such a case, giving it a statutory position could be a great impending risk. The new draft Bill

[10] https://pib.gov.in/indexd.aspx last accessed on June 18, 2025

does try to address some of these concerns, although it reiterates complete faith in DNA technology. DNA profiling is "an accurate and well established scientific technique", says the Law Commission report that has proposed the new draft. Questions such as whose DNA may be collected and what the circumstances would be, how important is the consent of the individual, who can access the database, and the circumstances under which a record can be deleted, have been raised repeatedly but as every new piece of legislation, this one too has its fair share of uncertainties and reservations and how it evolves is a matter of great anticipation.[11]

REASONS FOR WITHDRAWAL

- The 2022 Criminal Procedure (Identification) Act's redundancy
  The Criminal Procedure (Identification) Act, which was passed in April 2022, already addresses the majority of the Bill's provisions, including DNA sample collection, data usage, and storage regulations, therefore additional legislation is not required.
- Ignoring the Comprehensive Safety Measures Suggested by the Parliamentary Committee
  Strict protections, such as restricting the keeping of DNA from crime scenes, dissolving regional data banks, guaranteeing the independence of the board, and strengthening consent standards, were suggested by the Standing Committee on Science & Technology, which turned in its report in February 2021. Congressman Jairam Ramesh charged that the government had withdrawn the bill in order to avoid putting these suggestions into effect.
- Issues with privacy and profiling
  Civil society organizations and committee dissenters (Asaduddin Owaisi, Binoy Viswam) expressed concern regarding:
  Possible abuse resulting in profiling and surveillance, specifically directed at Muslims, Adivasis, and Dalits
- Excessive discretionary powers and weak supervision clauses that allow the government to replace the regulatory board or amend schedules without parliamentary oversight, as well as prohibiting judicial review, have been criticized for undermining checks and balances.

[11] https://thewire.in/government/dna-technology-regulation-bill-seen-to-harm-minorities-hurt-privacy#:~:text=The%20DNA%20Technology%20Regulation%20Bill,up%20a%20DNA%20Regulatory%20Board. Last accessed on June 21, 2025

- Lack of alignment with Puttaswamy (right to privacy) standards and missing data protection frameworks

Prevailing DNA laws in other countries and the International Human Rights aspect

United States

The DNA database in the United states was developed by the Federal Bureau of Investigation as Combined DNA index system (CODIS). The US Supreme Court in Maryland v. King held that in cases where officers are making an arrest for a charge of serious offence, they are authorised to take DNA samples from the accused individuals by way of collecting cheek swabs and the same can be legitimately used as evidence in the court of law and such intrusions of a person's privacy is valid under the Fourth Constitutional amendment.[12]

The Frye Test

The test for the admissibility of novel scientific evidence enunciated in Frye v. United States (54 App. D.C. 46, 47, 293 F. 1013, 1014 (1923)) has been the most frequently invoked one in American case law. A majority of states profess adherence to the Frye rule, although a growing number have adopted variations on the helpfulness standard suggested by the Federal Rules of Evidence. (a common-law rule of evidence: the results of scientific tests or procedures are admissible as evidence only when the tests or procedures have gained general acceptance in the particular field to which they belong.) [13]

Frye predicates the admissibility of novel scientific evidence on its general acceptance in a particular scientific field.

United Kingdom

The Criminal Justice and Public order Act in the United Kingdom is the basis for the National DNA Database (NDNAD). This act classifies certain offences as 'recordable' and anyone being processed under the provisions of such offences can be compelled to provide DNA samples to the police. The police, to an extent, is permitted to take DNA's of the arrested person before the investigating process begins so as to make the process faster.[14]

[12] https://pubmed.ncbi.nlm.nih.gov/8907857/ last accessed on June 02, 2025
[13] https://www.law.cornell.edu/wex/frye_standard last accessed on July 02, 2025
[14] https://www.ojp.gov/pdffiles1/nij/grants/203971.pdf last accessed on July 03, 2025

China

China passed a law allowing the Ministry of Justice and the Ministry of Interior to establish DNA Banks.

The essential things incorporated in this legislation are:

1) The offenders – convicts as well as suspects who are sex offenders have to provide for such samples voluntarily.
2) In case of refusal the prosecutor has the power to compel the person to do so.
3) The written and photographic samples of DNA can be retained for 10 years.
4) People who are suspected of committing a crime for which punishment is more than 5 years are required to give non intimate samples.

IN the case of DNA technology, the laws of the nations and the question of the fundamental human rights have mostly been at lock horns. The right to privacy has been enunciated as a basic human right in many international documents. The Universal Declaration of Human Rights, 1948 states that 'no one shall be subjected to arbitrary interference with his privacy, family, home or correspondence, attacks upon his honour or reputation. Everyone has a right to protection by law against such interference or attacks'. Further, the ICCPR, under its 'minimum guarantees' in Article 14(3)(g) mandates that everyone has a right not to be compelled to testify against himself or confess guilt.[15]

In case of Disaster Victim Identification the **International society of Forensic Genetics** has laid down guidelines that DNA laboratories must follow while dealing with such cases in order to adhere to the moral obligations that are begotten upon them. Further the creation of DNA database has many ethical and legal concerns which need to be addressed properly to eliminate the possibility of fundamental human rights violation.[16]

Application of DNA fingerprinting

1) **In Civil cases**
   a) **Establishment of paternity and maternity-** Most often the test is performed when the mother of the child is known but the father is in question. Since it is highly

[15] https://www.advocatekhoj.com/library/lawreports/humandnaprofiling/17.php?Title=Human%20DNA%20Profiling%20-%20A%20Draft%20Bill%20for%20the%20Use%20and%20regulation%20of%20DNA-based%20Technology&STitle=China last accessed on June21, 2025

[16] https://www.ncbi.nlm.nih.gov/books/NBK234535/

unlikely that any two people will have the same genetic fingerprint, paternity testing using DNA fingerprints is a reliable way to determine the parentage of a child.

b) **Establishment of biological relationship in immigration case-** Most of the time people are being shifted from one place to other in large scale which results in child being left behind. This technology is being used in such cases where question relating to nationality or biological relationship.

c) **Identification of child swapping case occurring in hospital-** it is a common problem in big hospital especially in USA, where child are being swept after delivery. This technique is used to identify the child.

d) **Identification of bodies in mass disaster cases-** This technology also proved to be very helpful in cases of mass disaster, because most of the bodies are in such a state that they cannot be identified by physical appearance. This technology could be used to identify such people.

2) **In Criminal cases**

a) **Identification of mutilated remains-** There are several instances when the body is found in so bad condition that it cannot be easily recognized. In such cases, DNA fingerprinting is a helpful technique to recognize a person.

b) **Identification of convicts in sexual assault case-** This method is generally used in such cases where the convict could not be found. In most of the cases of rape or sexual assault offender is generally not found. In such a situation DNA fingerprinting is a better way to find, because, even a small trace of semen or hair or other biological material would help to identify the accused, because DNA could be extracted from all of them.

c) **Resolving murder cases-** In criminal investigations, the DNA fingerprint of a suspect's blood or other body material is compared to that of the evidence from the crime scene to see how closely they match.

d) **Application in forensic medicine-** As we know genes carry information, DNA also contain information. They may contain very crucial information relating to a disease or its cure. This can also be used to study the pattern of evolution in human beings.

e) **Identification of exhumed bodies-** Sometimes bodies are found in such a condition that they cannot be identified with physical appearance, then this technology is being used to identify such exhumed bodies. This technology uses

f) **Identification of sex of human remains-** This situation arises when the body is in so bad condition that it cannot be found out that whether it is a body of male or a

female. In such a situation DNA fingerprinting technology can be used as a tool to analyse the sex of the body found. [17]

Drawbacks of using DNA fingerprinting technology

1. **DNA fingerprinting is still an imperfect science.**
   Having a technology that is 99.9% accurate may seem like a reliable technology. When that percentage is applied to real-life cases, however, it indicates that there may be 1 error in every 1,000 cases that are analyzed. With a prisoner population of about 2 million people, that would indicate that up to 2,000 people may have experienced errors with their DNA fingerprinting process and could be innocent. We must continue to work toward options that further reduce the chances of putting innocent people through a criminal justice system.
2. **There are privacy addresses we have not yet addressed.**
   Because the information from DNA fingerprinting can be stored indefinitely, there are specific privacy issues which we must address as a society. Should innocent people have their DNA profiles stored indefinitely? What about DNA information that is obtained through medical testing? Do doctors have an obligation to share DNA data from a medical file to law enforcement officials? Because we all leave DNA traces wherever we go, there is the possibility that it could be collected, stored, and even used against us in the future.
3. **Data protection issues create additional storage and privacy issues.**
   We've already seen how effective data hacking can be under specific circumstances. Millions of people have had their data profiles compromises over the past decade. Imagine how much damage could be caused if an individual's data profile contained DNA information instead of personal data and payment information? The ability to store DNA fingerprinting data must include an ability to properly protect it. Otherwise, we could experience new forms of identity theft that could be very difficult to combat.
4. **It requires information obtained to be properly interpreted.**
   Let's say that a major crime is committed at your local art museum. A famous painting, worth $300 million, has been stolen. You just happened to be at the museum the day before, looking at that exact painting. Maybe you put your hand on the wall next to it. Or maybe you had an allergy attack and sneezed a few times into a tissue, which you

[17] SV Subrahmanyam, Parikh's textbook of Medical Jurisprudence

then threw away. Your DNA is going to be collected there. You are going to be a suspect.

Forensic experts must properly interpret DNA information that is obtained for it to be useful. If that does not occur, the possibilities of incorrect convictions could increase, instead of decrease.

5. **People are overly influenced by DNA evidence.**

   Because of our exposure to forensic programming, such as CSI, there is a societal preference to place more regard on DNA fingerprinting over other forms of evidence. Despite the process not being 100% reliable, many treat the information this technology provides as being an irrefutable fact. Independent testing on DNA fingerprints has found that unrelated individuals can match on up to 9 out of 13 common markers used for evidence testing quite commonly. Some individuals can even match on 10 common markers, despite being complete strangers to each other.

6. **We could use DNA fingerprinting to create new classes within our societies.**

   We are already screening newborns for certain diseases which could negatively impact their lives. What if those same tests were used to evaluate the DNA profile of the child? Information about their future health could create classification probabilities. Certain people could be charged more for healthcare because they are more susceptible to cancer.

   Or what if some people are more likely to become obese, which causes medical providers to exclude diabetes coverage from that person's insurance coverage? The information from DNA fingerprinting can be used for a lot of good things. It can also be used for a lot of bad things as well.

7. **DNA fingerprinting information could be stored without personal permission.**

   When infants are tested for PKU in the United States, a blood sample is placed onto a filter paper card. The dried blood on these cards can be useful to maintain high levels of quality control at a laboratory. They can also provide public health benefits and offer assurance monitoring. The only problem with this practice is that some states in the U.S. store these cards, with personal DNA, for an indefinite period.

   Other states destroy the cards after a few weeks. You will need to check with your state's screening regulations to know what is stored and for how long.

8. **International agencies may have DNA fingerprints without personal permission.**

   In the United States, the National DNA Index System, or NDIS, was created in 1994. It has become the largest DNA database in the world. It contains 12.2 million profiles

from known criminals. It also contains 2.6 million profiles from people who were detained, but never convicted of a crime, and about 700,000 forensic profiles.

This database has assisted in more than 285,000 cases. It has also provided DNA information to other database systems around the world. Millions of people may have had their DNA fingerprints shared with other agencies without their knowledge or permission.

9. **DNA fingerprinting relies on human accuracy.**

DNA fingerprinting may provide another layer of evidence for law enforcement officials when building a case. It also relies on human judgment to create results that are available for interpretation. If an error occurs during the processing technique, then the results from the DNA fingerprinting may not be accurate. Improper handling techniques could affect the results as well. Incorrect result interpretation can also lead to wrongful conclusions about the information that was obtained. [18]

Conclusion

The profiling of DNA has begun in the 1980s after scientists discovered the VNTR or variable number tandem repeats in the hair strands of blood-related individuals. After several years, DNA fingerprinting already became available commercially in identifying criminals and resolve cases in the past. So, instead of examining the VNTRs, DNA fingerprinting will be examining the STRs.

Forensic investigation, these days, have become dependent on DNA fingerprinting to identify criminals. However, it will require weighing the advantages and disadvantages first because it is a highly critical application which could mean the life and death of the innocent person. Hence, authorities should be able to preserve the crime scene the best they can in order to avoid contaminating or inundating the DNA samples.

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