

The Age of DNA: Unraveling Mysteries and Impact on Justice Delivery

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Abstract: *The period we live in is often referred to as the Age of DNA, as advancements in DNA science have been remarkable in understanding the blueprints of life encoded in the human genome. DNA technology has revolutionized various fields, including medicine, biology, and forensic investigation. This paper explores the implications of DNA testing in criminal investigations and its impact on the judicial system in India. It examines the delicate balance between utilizing modern scientific discoveries and safeguarding individual rights, such as the right against self - incrimination and the right to privacy. The paper emphasizes the significance of DNA testing as an effective tool in crime detection, leading to a more secure society. However, it also highlights the need to address the ethical challenges associated with its implementation to ensure a fair and just legal system.*

Keywords: DNA Technology, Criminal Investigation, Forensic Evidence, Justice Delivery, Genetic code

1. Introduction

The period in which we are now living may go down in history as the "Age of DNA". There is no doubt that one of the most remarkable achievements is the progress of the science in unravelling the mysteries of the blue prints for life encoded in the human genome. The discovery of DNA technology has not only led to formidable advances in medicine and Genetics biology but had made an enormous impact on law in such areas as of forensic investigation. It is one of the latest forms of evidentiary tool in the hands of law enforcement agencies.

Due to such modern scientific and technological revolution and its impact on different aspects of our social and cultural activities we may often find a shift from old age traditional ideas based on subjectivism in our major intellectual exercise. This type of shift has put a serious challenge to our conventional adversarial value based system of justice. Today, the most pertinent question which generates much debate among the jurists, judges, scientists, lawyers and academicians in every legal system is how far the present value based system of justice requires to be changed or modified or re - oriented for the purpose of utilizing the benefit of modern scientific discoveries and technological advancement in justice delivery system.

There is no doubt that this new technology of DNA testing can be used as an effective tool in crime detection to accelerate crime control for a better society. But we cannot overlook the fact that it cannot be implemented in any legal system without hampering some basic human rights of an accused like right against self - incrimination, right of privacy etc. therefore, the problem that the law makers and the judges would face in introducing this new technology, is how to make a susceptible balance between the above two conflicting interests of the society.

DNA testing has assumed great significance in recent years as an important tool for law enforcement agencies. The focus of most criminal investigations is on linking evidence from the crime scene to suspects and for that purpose DNA evidence has played an increasingly important role.

Technological advances have made it more reliable, efficient and acceptable, exonerate those wrongly convicted. DNA evidences are widely used and are rapidly replacing serological evidence for resolving various issues like parentage etc.

Biological Consequences of DNA & Testing Procedure

Deoxyribonucleic acid (DNA), a long, double - stranded molecule that resembles a double helix or a twisted rope ladder, is what makes up all living things. The sides of the ladder are made of alternate phosphate and deoxyribose sugar units, while the connections are made of the bases adenine (A), thymine (T), guanine (G), and cytosine (C). Amino acids make up the majority of DNA, and when they are paired with so - called bases, they form the genetic code. In the human body, DNA is present in every single cell. The average human possesses roughly 250 gram of DNA, which is about 5 pictograms in size in each nucleus. The ideal amount is measured in micrograms for DNA fingerprinting. A variety of materials, such as hair samples, cigarette butts, blood, razor clippings, or saliva, can be used to extract DNA. As a result, samples can be collected very easily and examined in a lab to identify any potential genetic links.

Our biological mother and father each contribute one half of their DNA to the creation of our DNA. Biological children receive 50% of their parents' DNA. With the use of a DNA paternity test, this guarantees that each person's DNA is unique and enables precise parentage and direct descendant testing. There are two primary sorts of such testing methods, despite the fact that many different processes are used for forensic matching and identification of a person. These tests are known as polymerase chain reaction (PCR) and restriction fragment length polymorphism (RFLP).

The majority of the time, the RFLP testing procedure calls for bigger volumes of DNA, and the DNA must be pure in order to get accurate findings. RFLP testing is not suitable for tiny amounts of DNA sample, but PCR testing just needs a minimal bit of DNA sample. However, because of how sensitive this test is, even the tiniest contamination at the crime scene might affect or change the outcomes. Because RFLP takes a comparatively greater amount of DNA than

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other DNA analysis methods, it is no longer as widely employed as it previously was. Additionally, RFLP does not perform well with samples that have been impacted by environmental variables like dirt or mould. The PCR - based test has now supplanted the RFLP. Since a little amount of material may be amplified to a larger amount, it is essentially an amplification method. The target region must be replicated several times.

Evaluation of DNA as an Evidence in Criminal Investigation

In criminal trials across the nation, DNA evidence is utilised more frequently than ever before to condemn the guilty and clear those who have been falsely charged or convicted. Because of their expanded position, victim assistance providers must be more capable of comprehending the possible implications of DNA evidence in the instances of their clients. Ongoing forensic DNA analysis has a significant influence on the criminal justice system. The advantage of this revolution is that it provides better opportunity to find the guilty and clear the innocent. For instance, modern DNA technologies now make it feasible to analyse a wider variety of smaller and more diverse biological samples than was previously conceivable.

Francis H. Crick and James D. Watson, two scientists, published the first description of DNA, often known as the genetic code or building block of life, in 1953. DNA's double - helix structure, which resembles a twisted ladder, was discovered by Crick and Watson. They also demonstrated that DNA serves as the component of the genetic code of living things. The arrangement of the chemical elements that make up a living form's DNA influences how that life form develops. Whether it's a skin cell, sperm cell, or blood cell, all of an individual's body's cells have the same DNA. No two people, with the exception of identical twins, have the same DNA structure.

The English scientist Alec J. Jeffreys originally suggested DNA analysis in 1985. By the late 1980s, commercial laboratories and law enforcement organisations like the Federal Bureau of Investigation (FBI) were carrying it out. Comparing certain DNA molecule fragments from several people makes up the process. Due to the fact that a DNA molecule has billions of segments, just a small percentage of a person's complete genetic code is examined.

A DNA molecule from the suspect is first dismantled, and then certain segments are separated and quantified using highly specialised scientific equipment for DNA analysis for a criminal inquiry. Then, in order to determine whether the two profiles match, the suspect's DNA is matched to a sample of physical evidence. The suspect might not be taken into account if there is a definitive non - match. The likelihood that the physical evidence sample originated from someone else whose DNA matches the suspect's is calculated if a match is made. In deciding whether a defendant is guilty or innocent, juries rely on this statistical finding.

The most fundamental level of human variability the level of genetic material, DNA can now be studied thanks to DNA technology. Instead of DNA itself, previous techniques have

examined gene products using blood types and proteins. DNA can tolerate environmental factors that breakdown proteins and provides more direct genetic information, therefore ancient, severely deteriorated body fluid samples nevertheless contain a wealth of information. The likelihood that two unrelated people (or even close relatives, with the exception of identical twins) will share all of the DNA segments (markers) used for comparison is vanishingly tiny if the array is sufficiently big.

The methods used to analyse DNA are currently highly potent and will only get stronger. The likelihood that two distinct people would share all of the DNA markers used for comparison drops dramatically as the number of markers increases. The uniqueness of each person on the globe (apart from an identical twin) is likely to be verifiable in the near future with the help of adequate DNA test equipment. In the meanwhile, probability calculations that make use of population genetics concepts provide the foundation for the conclusion that two similar DNA profiles originate from the same person. Of course, these numbers might be inaccurate. We err on the side of conservatism (that is, in favour of the defendant) wherever possible. We also go through strategies for minimising laboratory and other mistakes. We stress that DNA analysis is a highly potent forensic tool when done correctly and evaluated. The application of new and more complex developments in science and technology is not limited to DNA analysis alone. Epidemiology, survey research, economics, and toxicology are a few of the topics covered. As with forensic DNA analysis, the approaches are becoming more sophisticated and statistical. The arduous task of taking into account the various traditions in the two fields is at the intersection of science and law where the problems lie.

Historical Development as Admissibility of DNA in Indian Court

Numerous instances mostly paternity disputes have been resolved through DNA analysis, and the majority of these cases were resolved at the CCMB in Hyderabad, Andhra Pradesh, India. When it was brought before the C. J. M. Telicherry (Thalassery), Kerala, the first paternity dispute case involving DNA analysis which was also conducted at CCMB (A. P.) hit the whole Indian Judicial System and media. According to the case description, Vilasini, a country girl, sued Kunhiraman, his boyfriend, for failing to pay child support for Manoj, her son. She claimed that their unlawful relationship led to the birth of her kid.

Her spouse disowned her and refused to acknowledge that he was her son's father. The C. J. M. required both of them to participate in a DNA test at the CCMB in Hyderabad, India, together with their kid. The DNA test was carried out by **Dr. Lalji Singh**, a forensic scientist, and his colleagues. Based on the analysis's findings, it was established that **Kunhiraman** was the father of the disputed child. In this instance, the FSL utilised the Bkm 2 (8) probe while admitting the DNA evidence in case no. M. C.17 of 1988 (the Vilasini case). The C. J. M. stated that DNA evidence is also a scientific examination under Section 45 of the Indian Evidence Act, where expert opinion is admissible, and that the opinion of a cellular and molecular biology expert is admissible similarly to the opinion of a chemical analyst or a

fingerprint expert. The Kerala High Court supported this decision, finding that the results of a DNA test by itself may determine paternity.

With the exception of identical twins, no two persons have the same DNA, making DNA a potent investigative tool. As a result, DNA evidence gathered at a crime scene can be used to identify a suspect or exclude them from further investigation. For instance, biological evidence from a sexual assault, such as hair, skin cells, semen, or blood, may be left behind on the victim's body or other areas of the crime scene. A suspect can be located at the scene of the crime using properly acquired DNA and known samples. A DNA profile from crime scene evidence can also be placed into the FBI's Combined DNA Index System (CODIS) to identify a suspect anywhere in the United States or to connect serial crimes to one another if there is no known suspect.

The gathering and examination of elimination samples in order to pinpoint the DNA's precise source may also be necessary for the efficient use of DNA as evidence. Any person who had authorised access to the crime scene and may have left biological material may be asked for an elimination sample. To account for all DNA discovered on the victim or at the crime scene, it could be essential to collect an elimination sample from everyone who had consensual contact with the victim within 72 hours of the alleged attack while looking into rape cases, for example. Results may be made clearer by comparing DNA profiles from the evidence with the samples used for the exclusion process.

2. Effect of Fundamental Right during Criminal Investigation

• Right to Privacy:

In Indian Context, it is important to note that India is a signatory to International Covenant on Civil and Political Rights, 1966, and right to privacy is derived from Article 21 of the Constitution and from Directive Principles of State Policy and it was held in **People's Union for Civil Liberties v. Union of India**, that right to privacy enshrined in Article 21 cannot be curtailed except according to procedure established by law. No one shall be subject to arbitrary or unlawful interference with his privacy, family and home, or correspondence, nor to unlawful attacks on his honor and reputation; does everyone have the right to the protection of the law against such interference or attacks.

In the famous case in relation to DNA investigation **Sharda v. Dharmpal**, the Hon'ble Supreme Court discussed the right to privacy in a systematic chronological order. The right to privacy has been developed by the Supreme Court over a period of time. In **M. P. Sharma v. Satish Chandra** in the context of search and seizure, the Court observed that: "When the Constitution makers have thought fit not to subject such regulation to constitutional limitation by recognition of a fundamental right to privacy, analogous to the American Fourth Amendment, we have no justification to import it, into a totally different fundamental right, by some process of strained construction."

• DNA and Self - Incrimination

The discovery of genetic fingerprinting with its high specificity and extraordinary probative properties highlights the question of the scope of the privilege against self - incrimination. The fact that the public would probably see DNA fingerprinting as harder to fabricate, as more objective than a verbal statement, it may also mean it is more difficult for the individual to refuse and for his refusal to be seen as legitimate. Fear, anxiety, embarrassment, and anger, rather than guilt, may account for non - cooperation in supplying a bodily sample just as they may account for silence. The suspect may be apprehensive regarding how the test is conducted and more importantly, how accurate it is, especially if he does not understand what the test involves or lacks confidence in the testing procedures and controls.

The question that now comes to mind is whether or not it is legal for the courts to ask the accused to supply a sample of his DNA for the analysis. What is of concern here is that does forcing the accused to provide a sample of his DNA amount to a violation of the protection against self - incrimination? Also, if the accused refuses to give the sample then does that mean that an adverse inference will be drawn against him?

In the case of **Goutam Kundu v. State of W. B.**, there was a question of disputed paternity. The Court held that no person can be compelled to give sample of blood for analysis against his/her will and no adverse inference can be drawn against him/her for this refusal. The constitutionality in taking a fingerprint was challenged in the case of **State of Bombay v. Kathi Kalu Oghad**.

The Supreme Court held that Article 20 (3) of the Constitution gives protection to a person not to be a witness against himself. However, "to be a witness" is not equivalent to "furnishing evidence" in its widest term and significance. Giving thumb or finger impression or exhibiting parts of the body by way of identification are not included in the expression "to be a witness". Being a witness has been interpreted to mean imparting some sort of knowledge in testimony. From this it appears that there will be no constitutional restriction on the collection of samples for DNA analysis.

3. Recommendation for Effectiveness of DNA Technology

- For the purpose of crime investigation, Section 53 CrPC should be more specific, clearer, more unambiguous, more meaningful, and more purposeful so that an investigating officer may not face any difficulty for the purpose of crime investigation.
- There is a necessity to amend the provisions of the Criminal Procedure Code, to include the scientists of this institute in Section 293 (4) CrPC and to treat their reports as evidence. Otherwise it is difficult for these experts to go around the country for giving evidence at every trial, in cases where they are to give expert opinion.
- Article 20 (3) of the Constitution of India has to be reinterpreted to the effect that the accused should not get protection of this article when the investigating officer or

the court direct him to give DNA sample for the purpose of investigation and if he does not give consent then an adverse inference should not be drawn against him.

- A specific unambiguous scientific DNA legislation is the paramount need of this age for effective application of this new gift of forensic science in our legal system.
- In the line of the US DNA Identification Act of 1994, we have to make a specific DNA legislation which would authorise to set up the combined DNA Index System (CODIS), This infrastructural set - up, laid down in the said legislation, will provide error - free result of DNA testing in our country.
- DNA sampling involves intrusion into three forms of individual privacy; bodily privacy, genetic privacy and behavioural privacy and respect for human dignity need not be abandoned when balancing civil liberties with the larger interests of the community. Formulation of sound privacy principles can enhance the integrity and legitimacy of DNA profiling.
- Legislation should be enacted to ensure that only government - recognised laboratories in accordance with the regulatory requirements that may be statutorily laid down conduct DNA parentage testing in India. The Family Courts Act should be amended to provide a special chapter dealing with DNA parentage testing.
- Again, the law should recognise a child right to give or withhold consent to the testing of his or her own genetic sample where the child has acquired sufficient maturity and understanding of the process and its implications to safeguard his or her own interest.

Lastly, under Article 245 of the Constitution of India, Parliament is legislatively competent to make laws with respect to the Union agencies and institutions for professional, vocational or technical training, promotion of special studies or research, or scientific or technical assistance in the investigation or detection of crime and with respect to coordination and determination of standards in institutions for higher education or research and scientific and technical institutions (Entries 65 and 66 of the Union List).

4. Conclusion

The DNA test is a powerful tool in the criminal justice system, but in civil proceedings, the socioeconomic situation and unique characteristics of our nation deem this test to be in violation of human dignity, particularly for women and children. However, for the purpose of justice, the truth, and the dignity of the innocent person as well as for the sake of the openness of judicial proceedings, the inherent power of courts in civil affairs as set forth in Sec.151 C. P. C.1908 shall prevail.

The DNA Profiling Bill 2007 is the appropriate legislation that will establish the infrastructure, standards, quality - control with assurance obligation of DNA laboratories, information, composition, qualification of DNA profiling board & its members, function, and most importantly, the use of DNA technology in matters of human dignity, human right, and human relationship. For this reason, we are eagerly awaiting this legislation. The DNA Profiling Bill 2007 covers a wide range of DNA issues related to criminal

cases, which is why it has that name. However, it would be more beneficial if it included safeguards protecting the privacy and dignity of all residents. The name of this measure should thus be DNA and Dignity measure.

The justice administration system has to incorporate DNA profiling's scientific advances and establish procedural strategies to address the new legal problems. The important DNA fingerprint concepts cannot be left up to the courts to decide using ad hoc, temporary remedies. Therefore, Section 112 of the Indian Evidence Act, 1872 cannot be used to assess the child's legitimacy or illegitimacy in cases of contested paternity. Without hesitation, DNA technology should be used since it can definitively demonstrate the truth in such disagreements. It is important to keep in mind that even the discovery of DNA was not anticipated when part 112 was written, hence this part has to be updated.

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