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REVIEW ARTICLE

DNA Finger priniting in Indian Criminal Justice system: Future Prespectives

Saini M,[1] Choudhary S,[2] Sharma P,[3] Saini D.[4]

Assistant Professor,[1] Professor,[2] PG 1st year,[3] MBBS 1st Year.[4]

1. Physiology, Mahatma Gandhi Medical College and Hospital, Jaipur.

2,3. Forensic Medicine and Toxicology, Mahatma Gandhi Medical College and Hospital, Jaipur.

4. NIMS, Jaipur.

Abstract:

DNA Fingerprinting has brought a new revolution in the crime scene analysis in the recent years. It has helped to identify the criminal and absolve the innocent in many crimes and is also being used extensively for identification purposes and determining the biological parentage of an individual. Human DNA profiling on one hand is proving extremely useful in providing justice, but on the other hand its regulation is imperative to ensure its use only for lawful purposes. DNA profiling is scientific, reliable and unbiased. The main areas of concern are the cost effectiveness, lack of experts, sample collection and preservation and avoiding errors like cross contamination. Much needs to be done both at technical and at medico-legal fronts before making full use of the potentials of DNA profiling.

Keywords: DNA fingerprinting; Crime; Justice; Criminal Law.

Introduction:

Crime has always been and will be a part of human civilization. Forensic science aims to collect the evidence that may be helpful in proving or disproving the association of an individual to a particular crime. Forensic DNA analysis or DNA Fingerprinting has transformed the criminal investigation all over the world. DNA fingerprinting has added new dimensions to crime investigations and has proved to be very helpful to police and judicial system. Databanks are planned to be set up at both national and regional levels to store DNA profiles received from accredited labs. Collection, preservation and transportation are the integral part of DNA fingerprinting. DNA fingerprinting has proved useful in various areas like -

- Paternity conflicts
- Sexual assaults
- Crime scenes
- Mass Disasters

Earlier forensic scientists were using techniques like blood grouping, HLA typing and isozyme grouping on the biological samples found at crime scenes.[1] These tests used proteins, which get naturally degraded and denatured. Thus, there was necessity for some living material which is stable and at the same time variable and individual specific.[2] The discovery of DNA fingerprinting proved to be exactly the biological material needed. DNA fingerprinting has had a major impact on the criminal law after it was first used in 1980's. It has been extensively used in criminal law to establish guilt or innocence, establish paternity in family law and also prove blood relationships or to establish citizenship in immigration law and identification purposes in mass disasters.[3] Legal system has now given DNA fingerprinting the exact credit that nature has given it, it is referred as "The blue print of life".

Corresponding Author
Dr. Sanjay Choudhary
Email: dr.choudhary.sanjay@gmail.com
Mobile No.: +91- 9983959538

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What is DNA fingerprinting?

DNA is the carrier of genetic traits. On September 10,1984, Prof. Alec Jeffreys and his team at Leicester university identified a 'barcode' and realized that this barcode can be used as an identification tool for living things. Except in the case of identical twins, a part of the DNA varies from individual to individual. Some portion of DNA is thus as unique to an individual as fingerprint.[4] Alec Jeffreys and his colleagues named the process for isolating and reading these DNA markers as "DNA Fingerprinting". This provides a full proof method of establishing identity of a person. The first case where DNA was used was in 1983 in Leicestershire village of Narborough involving the rape and murder of two 15-year-old girls.

DNA fingerprinting is a technique that detects DNA portion unique for every individual. It is an extensive process that involves molecular biology, genetics and analysis. DNA analysis is a reliable tool for resolving certain critical issues in crime investigation.[5] A major portion of DNA is the same, it is only 0.1% DNA that is unique. Forensic scientists go through 15 different regions of DNA fragment and use this data to create a DNA profile of that individual. In criminal cases, DNA is extracted from different samples like hair, nail, bone skin etc and analysed for the presence specific DNA regions (markers). When we talk about DNA fingerprinting, we often tend to think of television shows like CID or CSI, in which DNA sample is collected, sent to lab and within minutes suspect is identified. The real picture of DNA analysis is entirely different because it is often not possible to get adequate and perfect sample of DNA from crime scenes. Contamination of DNA samples or " DNA mixtures" because of being handled by more than one person and degradation of the sample available are some major issues faced by forensic experts at crime scenes.

Techologies used in fingerprinting –

(i) Restriction Fragment Length Polymorphism (RFLP)- This was first technique that was adopted for forensic DNA analysis, but it required a greater amount of better quality DNA.

(ii) PCR Analysis- In Polymerase Chain Reaction (PCR) exact copies of DNA are made from the available biological samples. Hence small amount of DNA is sufficient for analysis.

(iii) STR Analysis- This is the most recent method of DNA profiling. Short tandem repeat (STR) is also called microsatellite analysis has advantage of higher discrimination and also lesser time is required to obtain results. It also needs a smaller sample size. STRs are locations (loci) on chromosome that repeat within the DNA. The repeat sequence is of 3-7 bases, the entire length of STR is less than 400 bases. So, the susceptibility of STRs to degradation is less and it can be obtained even from bodies or stains that have undergone decomposition. The "Federal Bureau of Investigation (FBI)" employs a standard set of thirteen specific STR region.

The steps in STR analysis are as follows:

- Extract and purify DNA from biological sample.
- Amplify selected genetic markers through polymerase chain reaction.
- Genotyping.
- Statistical analysis and final interpretation of the DNA sample.

(IV) Mitochondrial DNA analysis (mt DNA) mt DNA is valuable in investigation of long standing unsolved cases.[6] Older biological samples like hair, bones and teeth can be analysed with mt DNA. Mitochondrial DNA is proving to be useful in maternity disputes because mitochondria is from mother's egg cell. Male sperm contributes only nuclear DNA to the embryo.

(V) Y-chromosome Analysis- The Y-chromosome passes from father to son and hence proves useful in paternity issues.

(VI) Rapid DNA ID Microchip-based Genetic Detectors- this included laptop analysis units that can be used at crime scenes.

Applications of DNA Fingerprinting: DNA fingerprinting has proved to be of utmost importance in both civil and criminal cases

(A) Civil Cases

1. To prove paternity/maternity of an individual
2. Solve 'switched babies' cases
3. Determine the immigration status
4. Identify victims of accident, fire, natural disasters etc
5. Forming family lineage

(B) Criminal Cases

1. Solve murder crimes
2. Link a victim and culprit in sexual assaults

Figure 1. DNA Fingerprinting.

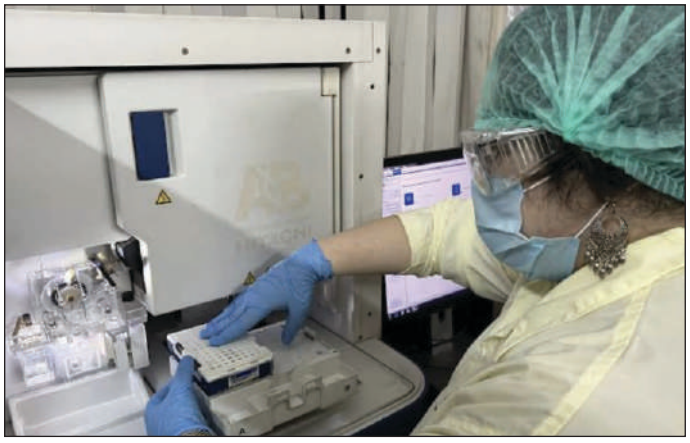

Figure 2. DNA forensic lab in India.

3. Identify mutilated bodies and skeletons or remains.
5. Solve crimes involving animals
6. Solve crimes involving plants or poisons.

DNA Fingerprinting- Scenario in India- DNA fingerprinting is extensively being used in India especially in cases of unidentified bodies, paternity and maternity issues and sexual assault cases to establish link between victim and accused.[7] The method of DNA profiling being done in India is PCR and STR. Dr. Lalji Singh was the first Indian to use this technology of DNA fingerprinting in 1988. He is called the "Father of DNA fingerprinting". Though many states have their own forensic DNA fingerprinting lab, still there is a need of many more. In the state of Rajasthan, there are presently three labs, one each in Jaipur, Jodhpur and Ajmer. The central government labs are also there, state of art lab doing extensive DNA profiling is the " Centre for DNA fingerprinting and diagnostics (CDFD), Hyderabad". It is now possible to identify an unidentified or decomposed body even if a fragment of bone is available. In mass disasters, it is now easier to identify persons by this technology.[8] Question of bacterial, other microorganism or foreign DNA contamination does exist but newer techniques of DNA collection, sampling and transportation are overcoming these issues. These techniques are helping the judicial system of India to provide justice in cases of crimes as early as possible in the courts of law.[9] National DNA

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databanks are planned to be set up in India soon . Many countries already have databanks. When a DNA sample of a suspect from a crime scene matches the DNA from a National databank, that link is known as "Cold Hit". Cold Hit is very helpful to the police to identify the accused. Touch DNA is proving to be very useful in crime scene forensic investigations.[10]

DNA Profiling and Constitutional and Legal Provisions in India-

The fundamental legal document is the Indian Constitution. Part III of our constitution guarantees Fundamental Rights of freedom to the people of India.

Article 20(3) of the Constitution provides safety of an individual from being a witness against himself. Further, Article 21 prohibits unauthorised interference in the life and personal freedom of each person. Hence DNA profiling technology must meet the requirements of Article20(3) and 21 of the Constitution.

"Code of Criminal Procedure (CrPC)" under section 53 and 53-A establishes the framework for DNA profiling of persons in criminal investigations. "Section 53(1) provides for DNA profiling of the accused at the request of the Police. Section 53A also provides for DNA profiling of those accused of rape. The Indian Evidence Act 1872, under sections 45-51, provides for the "admissibility of expert opinion as a relevant fact in courts."

Article 21 of The Constitution of India declares that "No person shall be deprived of his life or personal liberty except according to procedure established by law".[11] The Indian Supreme Court declared DNA profiling to be a reliable and effective technique to compare suspect DNA with sample DNA collected at the crime scene.[12] DNA evidence is now a predominant forensic technology to identify criminals.

DNA fingerprinting is not considered as evidence under Indian Evidence Act 1872 and Criminal Procedure Code 1973. DNA needs to be properly collected, preserved and documented before being presented to the court as evidence.[13] Section 53 of Code of Criminal Procedure 1973 gives authority to a police officer to get the assistance of a medical practitioner for investigation purpose."

The amendment of CrPC by the CrPC (Amendment) Act ,2005 includes two new sections. This allows the investigator to collect DNA samples from the body of the individual accused and the victim with the help and under the guidance of a medical practitioner. Still there are doubts about presenting DNA as evidence in courts even though courts do not deny the accuracy and reliability of DNA fingerprinting. There is a definite and urgent need to re-examine these sections of Criminal law so as to manage the science and technological issues in order to provide justice. The DNA technology bill 2019 is to regulate the use of DNA fingerprinting technology in India.

Conclusion:

DNA fingerprinting is a significant development in forensic criminal science. It is being used extensively in forensic and judicial system but new laws need to be implemented for its correct use in legal matters. In coming years, new technologies of DNA fingerprinting are going to revolutionize the legal system of our country. Till date India does not have DNA legislation like Canada and many other countries. Much needs to be done before DNA technology can be used to its full potential for criminal and civil matters. It is however clear and well accepted that DNA fingerprinting will soon emerge to be the most reliable and useful tool in criminal investigation.

References:

1. Sharma BR. "Forensic Science in Criminal Investigation & Trials", 15 ed, New Delhi: Universal Law Publishing; 2016:3.
2. Modi JP. "Medical Jurisprudence and Toxicology". 22 ed, Lexis Nexis Butterworths; 2001: 31.
3. Gupta BD. Mass Disasters :a preparedness plan book with particular emphasis on mortuary services. JIAFM; 2004(26).
4. Rani UR. "DNA Evidence and the Courts". KLJ; 2008 (8): 2.
5. Jain. "DNA technology and its Impact on Law". NLR; 2006(3).
6. Monir M. "Law of Evidence", Universal Law Publishing Co.; 2005(14)14:1004.
7. Justice R.K.Abhichandani. "New Biology & Criminal Investigation"; 2004:4.
8. Modi JP. "Medical Jurisprudence and Toxicology". 22 ed: Lexis Nexis Butterworths; 2001:p 65.
9. Nabar BS. "Forensic Science in Criminal Investigation". Asia Law House; 2012(3): 348.
10. Sinha S, Yadav B, Bumbrah GS. Potential Utility of Touch DNA in Forensic Investigation JIAFM; 2021 (43):2.
11. Malviya MK. 'DNA Fingerprinting as an Evidence and Role of Indian Supreme Court' IJCF; 2017(2):1.
12. Adhikary J. "DNA Technology in Administration of Justice". Lexis Nexis Butterworths; 2008:14.
13. Tandon N. "The Journey from One Cell to Another: Role of DNA Evidence"; 2004.