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Role of DNA Technology in Investigation of Crime

Abstract

Deoxyribonucleic acid popularly known as DNA is a genetic information hidden in the body of the person. It can be collected from blood, skin cells, nails, saliva and other bodily substances. This genetic material has power to reveal the true identity of the person. The scientific evidences are highly reliable in a court of law. The scientific evidence i.e. DNA is increasingly used in criminal trials.DNA can also protect a person when there is a wrongful conviction and it can also be used in paternity cases. This evidence is highly reliable when identity of the person is yet to be established. There are various factors to be taken into consideration while admission of DNA evidence. In order to consider the full potential of DNA the procedural rules and the questions of scientific facts must be addressed. The scientific evidence like DNA demands special treatment in the court of law.

Keywords: Deoxyribonucleic Acid, Genetics, Scientific Evidence.

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Introduction

> "*The principal limitation of criminal justice is that, for most crimes, totality of evidence available to the investigating authorities is insufficient to establish who commits the crime. So guilty people are acquitted or not brought to trial. More rarely, innocent people are convicted because there is insufficient evidence to exculpate them. All else being equal, justice is promoted by any technical development that allows courts to find out with increased precision who commits crimes. The use of DNA profiling is one such development, so a criminal justice system is morally required to use DNA information unless there are overwhelming reasons why it should not.*"
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> *John, F. Y. Brookfield*[1]

Solving a criminal case is a tough task for investigating agencies and courts. The challenges faced by criminal courts are not as simple as it may appear at the first instance, i.e., to correctly identify the perpetrator of a crime. The advent of DNA identification has revolutionised the crime detection techniques. It has a high degree of certainty than other scientific methods. In paternity disputes and homicidal cases DNA evidence has an awesome capability to convict the perpetrator or exonerate the wrongful convictions. The basic aim of the DNA profiling is to identify the real source of biological evidence collected from the scene of crime[2]. The criminal justice system now trust greatly on DNA based information[3]. DNA evidence has the greatest probative value among all the scientific and technical evidences in identification of an individual.

Hence DNA evidence can provide three types of results as follows:-

1. Inclusion, when a DNA specimen recovered from the scene of crime, whether of victim or suspect matches with the DNA profile of an individual.[4]
2. Exclusion, when the DNA sample recovered from the scene of crime (victim or suspect) does not match with the DNA profile of an individual, and[5]
3. Inconclusive where DNA results are unable to produce an information on the basis of which an individual to be either included or excluded as a source of biological material.[6]

The real investigative power of DNA technology is realized in the context of the cases where a suspect has yet to be identified.[7] DNA techniques can greatly help the criminal justice system in dissemination of justice. The scientific and legal community has accepted its reliability through scientific and legal literature, highlighting its practical and

theoretical aspects[8]. Indian courts have accepted DNA evidence in number of cases. Scientific and expert testimony in India has extended to those areas which are more complex and technical.[9] It is quite clear that a criminal case cannot be solved without taking a scientific assistance.This paper is aimed at to illustrate the fundamental aspects of DNA, its origin and development and its relevance in criminal justice system.

Objective of the study

The complete objectives of the study are as follows;

1. To study in detail the impotence of DNA evidence in investigation and trail of the criminal offences.
2. To analyse the potential value of the scientific investigations.
3. To suggest certain precautions while collection of DNA samples i.e. uniformly accepted methods for quality assurance and standardization of scientific and legal practices.
4. To study in detail the legal standards of admissibility of DNA evidence.

The objective of this article provides the basic overview of DNA evidence in criminal cases.

Meaning and Nature of DNA

DNA is an abbreviation of "Deoxyribonucleic Acid". DNA is situated in the human body with some of its own distinguished features and structure. DNA is rightly called as "*blue print of life*" or individual's "*genetic bar code*".[10] DNA is found in every living cell.[11] It carries genetic information which is essentially required for the identification of an individual. DNA determines hereditary biological property that makes a person different from another person. Only due to that chemical composition of a living organism, a body can be identified by blood, semen, hair, nails, tooth enamel, etc.[12] DNA is capable to distinguish every individual from another individual except identical siblings or clones. This chemical composition of DNA determines one's colour, height, hair, and each and every characteristic of human beings[13]. The study of DNA is absolutely based on heredity; therefore it is mandatory to discuss the basic element of heredity.

Like property, every person inherits certain biological traits from his parents which is called as genetic heredity or DNA. It is the sum of the biological course by which particular characteristics are transferred from parents to their off spring.[14] However in DNA all biological traits are not transferred from parents to children. It is only the genotype[15] which is inherited from both parents and on the other hand phenotype[16] is non inheritable. One person is biologically different from another person due to the joint effect of both genotype and phenotype[17]. It is evident that the crux of DNA is transferring of the genetic material (which is known as genes) from one generation to another.[18]

Importance of DNA

According to Robert Pollock "The planets surface has changed many times over, but DNA and the cellular machinery for its replication have remained constant. No stone, no mountain, no ocean, not even the sky up us have been stable and constant for this long; nothing inanimate, no matter how complicated has survived unchanged for a fraction of the time that DNA and its machinery of replication have co-existed."[19] DNA cannot be changed in one's lifetime and even after a person's death it will remain unchanged.

The United States National Academy of Sciences in 1992 relied and sponsored a study conducted by the National Research Council (NRC) on DNA technology. The National Research Council on the value of DNA results has given following guidelines:

1. The current DNA procedures are reliable but they must follow the universal scientific protocols.
2. The forensic laboratories should follow the quality assurance programmes.
3. The laboratories conducting DNA testing should have proper accreditation.
4. The national DNA databanks should be established to check sexual offences and homicidal cases.

The proper observance of laboratory protocols and a reliable interpretation of DNA results will definitely enhance its practical value. DNA evidence has undoubtedly increased the efficacy of expert assistance and now it is important crime detection tool. DNA examination involves the usage of substantive physical evidence which is analysed through proper scientific procedures and it is free from any human error. DNA examinations are conducted by persons of specialised skill. The data created by those persons is verifiable by a second or even by subsequent DNA experts.

Tentative Location of DNA Evidence at Crime Scene

There is hardly any crime scene without DNA evidence. The actual identification and collection of DNA evidence is a prime task for courts and investigating agencies. DNA testing can produce millions of copies of DNA profiling from insufficient biological material. Some DNA techniques such as PCR (Polymorphic Chain Reaction Test) is very helpful to analyse poor quality DNA samples obtained from dirty crime scenes. Besides suspected persons there are other items of evidence that can be used to obtain DNA samples, these items may be as under:

Items of Evidence	Possible Location of DNA	Sources of DNA
Cricket bat, knife or similar weapon	Handle, edges or surface area	Sweat, skin or blood
Hat, mask or gloves	Inside the hat or mask	Hair, sweat or dandruff
Spectacles, sun glasses or lens	Nose buds or lens	Sweat, skin and tears
Facial tissue, used cotton or used napkins	Surface area	Mucus, blood, sweat, semen, ear wax
Dirty clothes	Surface area	Sweat, blood, semen,
Spoon or tooth pic	Surface area or tips	Saliva
Cigar and cigarette	Cigarette butt	Saliva
Stamp or envelope	Licked area	Saliva, sweat
Bottle, straw or glass	Surface area	Saliva
Used condom	Inside or surface area	Semen, skin cells and vaginal fluid
Bed sheets, carpets, pillow or blankets	Surface area	Hair, sweat, blood, urine
Bite marks or area licked	Bitten and licked area	Saliva and tooth enamel
Fingernail clippings	Scrapings	Blood, skin,
Bullets	Surface area	Blood and skin cells
Carpet	Surface area	Blood, hair, urine, semen

***Source**: Lee, *Guidelines for the Collection and Preservation of DNA Evidence,* 4(U.S Department of Justice, F.B.I., 1990)

Presentation and Admissibility of DNA Evidence

It is also pertinent to understand that how DNA test results are properly presented and successfully admitted into evidence. The presentation of DNA results include three questions that the court must consider in determining its admissibility.

1. The first question involves the admissibility of DNA evidence in the form of scientific summary reports[20].
2. The second question involves the offering of statistical importance of DNA test results[21].
3. The third issue addresses the analytical and legal conclusions drawn there from[22].

To understand the DNA test results in their proper context by the courts all three of these issues must be addressed[23]. The party, whether prosecution or defence, seeking to have DNA evidence admitted fails to fulfil any of these three components, then the DNA testing reports cannot be properly evaluated by the courts. The other major question relating to DNA evidence comes as an obstacle in the way of courts is the Article 20 (3) of the Indian Constitution. The Indian courts has many times held that extraction of DNA samples under the protective eye of law[24], does not amount to compelling an accused person to be a witness against himself and thus there is no violation of Article 20(3) of the Constitution[25] but still the protection of constitutional guarantees for collection of DNA evidence is a debatable issue in India.

Reasonsfor Choice of DNA Examination

It is pertinent to note here that only because one cannot see DNA samples that does not mean that there is no enough biological evidence for DNA profiling. Since only few cells are sufficient to obtain useful DNA information, the investigating agencies are required to employ best possible care for collection and preservation of DNA samples.

DNA identification is a reliable crime solving scientific technique. There are various reasons which made DNA a reliable method and choice of courts in dissemination of justice

1. DNA has very high power of differentiation. No two persons can have the same DNA composition and structure except identical siblings. Current forensic advancements such as genotyping systems has achieved power of exclusion or discrimination of one in several billions, ensuring that every DNA sample obtained is substantially different.
2. DNA profile is permanent and it cannot be changed with the passage of time. Other biometrical methods used for human identification change during the lifetime of an individual but DNA does not. It is also not possible to replace one person's DNA with another's.
3. It is the unique quality of DNA profiling that different types of DNA samples have identical DNA results. DNA samples obtained from different sources of same individual will have the same pattern irrespective of the biological origin. DNA result of a droplet of blood from one crime scene can be compared to a seminal stain obtained from a different scene and if that semen and blood relate to the same individual, identical DNA results can be acquired.
4. DNA is permanent and reliable results can be produced from very old and decomposed biological samples. DNA is more powerful than proteins when subjected to harsh environmental degradations. DNA is capable to bear both natural and manmade injuries.
5. The rich molecular composition of DNA structure allows scientists to analyze long buried samples as well as samples that have been subjected to environmental challenges i.e. high temperature and chemical treatments. DNA evidence can be successfully obtained by modern scientific approaches even when the biological material is severely degraded.
6. DNA is inherited both from father and mother. DNA profiles are always similar within family members. By using modern sophisticated scientific techniques it is possible to identify the culprit by analyzing DNA of close relatives.
7. Modern scientific and forensic techniques are fully capable to generate millions of exact copies

of DNA by specific chemical reactions which reveal genetic information from very small amount of biological material. A single tissue of skin, hair or small droplet of blood or sweat left at the crime scene is sufficient to procure a complete DNA profile, which can be used to identify the perpetrator of crime.

DNA testing can furnish vast amount of other information besides the famous DNA profiling. It is quite possible to give opinion about the gender of an individual, his or her hair, eye and skin colour, ethnic origin, biological age and even predisposition to specific diseases. No other evidence is competent of providing so much information about the individual whose DNA sample is analyzed.

Suggestions to realise the full Potential of DNA

DNA evidence is very sensitive kind of evidence therefore any negligence can render the whole process invalid, the following suggestions and recommendations can definitely enhance its practical significance:

1. The police officers must be given a proper training to evaluate the scientific evidence based investigations
2. It must be made necessary that the report of DNA test should contain the following essentials :-

(a) A detailed identity of the persons who have undergone DNA testing.
(b) Qualifications of the DNA expert who has prepared the report.
(c) A report should clearly identify the description of sample and circumstances under which DNA samples were taken from each person.
(d) A detailed analysis of the probe adopted for DNA testing.
(e) The result of DNA test in statistical terms.

3. The laboratories should follow the International standards for DNA test procedures.
4. The DNA testing must be conducted by an accredited laboratory with established and scientifically accepted credentials and sanctioned standards.
5. The proper accreditation of standardised DNA laboratories at the District, State, central and International levels must be established.
6. The DNA International regulatory body must be created to scrutinise the standards and protocols of DNA testing.
7. The legal issues relating to DNA testing must be addressed at the stage of investigation also.
8. DNA evidence must also be evaluated along with ocular testimony.
9. The court and investigating agencies should take an appropriate direct preservation of the DNA samples and also maintain the confidentiality of the same.
10. The panel of DNA experts or the association for promotion of DNA techniques must be formed and their services must be realised in the legal context.

DNA evidence is treated as a part of circumstantial evidence and needs corroboration like ordinary evidence. In present scenario DNA evidence is judicially recognised as genuine but its reliability in every case is a debatable issue. The reliability of DNA evidence can be enhanced by taking into consideration the following additional factors:

1. The educational qualifications of the person conducting the DNA test.
2. Methods and techniques adopted for DNA test.
3. A detailed identity of the person submitting himself or herself for DNA testing.
4. The nature of circumstances and the nature of offence for which DNA sample is required.
5. A detailed description of DNA sample obtained.
6. Whether DNA test was conducted with the consent of the person.
7. A brief analysis of the DNA test results.

All these factors must be added in the report of DNA test results to facilitate the administration of justice. After the fulfilment of all these conditions and necessary formalities; it will unequivocally demonstrate that there are no cogent reasons to disbelieve the reliability of DNA test report.

Rule of law must be prevailed over societal interests; even in that situation the total denial of Constitutional mandates is unlawful. It is high time to protect the civil liberties, especially in which police has to adopt scientific methods like DNA identification. It is undoubted that DNA evidence is necessary to unravel the truth but at the same time the Constitutional violations must be minimised. Here are certain suggestions to ensure the safety and integrity of suspects during collection of DNA samples:

1. The investigating agencies must be very careful and diligent in collection of DNA samples from the scene of crime. A potential error or misstep can render the DNA evidence inadmissible.
2. The entire procedure for collection DNA samples must be supervised by the competent authorities.
3. The maximum privacy must be assured to the suspected person during collection of DNA samples. Besides police personnel, the independent third party must also be present to witness the DNA sampling process.
4. DNA samples must be collected only when competent court orders to prove the charges framed against an accused person.
5. Strong and effective legal measures must be framed for protection of fundamental rights of an accused during DNA extractions.
6. It must be assured that forensic will be destroyed after the quashing of criminal convictions.
7. The admissibility of the DNA evidence must be upheld with regard to that evidence which is collected by the investigating authorities through illegal and unfair means.
8. The Court should issue appropriate orders to investigating agencies for proper preservation of biological material and confidentiality of the same should be maintained.
9. The DNA testing must be conducted by government accredited and approved laboratory with established scientific credentials which fulfils the international sanctioned technological standards.

10. The results of the DNA evidence should be interpreted before courts in a simple language.
11. The technical aspects should be supervised by law enforcement agencies from transportation to statistical interpretation of DNA test results so that integrity and identity of samples are preserved.

The contamination issues, the partisanship issues and possible error rates like statistical errors and mutations of DNA samples can adversely affect the results of DNA testing. Therefore, it is mandatory for the courts and investigating agencies to adopt extra caution while dealing with the DNA evidence. The courts should not accept the results of DNA as it is, instead they should corroborate DNA evidence with other available evidence. A detailed analysis and interpretation of DNA test results should be compared with the other already decided cases of similar nature.

The DNA evidence is infallible if the chain of custody of the samples is maintained. The chain of custody indicates the collection, preservation and documentation of biological samples. DNA testing demands care and proper handling of biological material because any human error can result into wrongful convictions and wrongful acquittals. In DNA related cases pendency of a case for a long time hampers the smooth process of criminal justice delivery system, during that period DNA samples are usually handled by many investigating officers as a result of it DNA evidence may be reinvestigated and mishandled. The same biological specimen may be subjected to various forms of DNA testing. Evidence tendered in one case may be sent for PCR examination but due to long pendency of criminal trial an mtDNA testing may be required in the same case on later stages. In all criminal investigations chain of custody issues are required to be maintained to preserve the quality and efficacy of the particular evidence.

There are numerous fundamental differences between legal and scientific procedures. The science has an ability to provide the error free results which can help and accompany legal decisions. If these scientific results do not get any statutory recognition, the results may or may not be admitted in a Court of law.

The 'in build' or 'in house' DNA testing procedures produces the inaccurate and wrong conclusions. At the same time the partisanship contributes to the production of biased results. Some countries keep strict vigil on the proficiency of DNA testing laboratories but India is far behind regarding establishing regulatory check on these laboratories. Therefore it is a right time to introduce a quality control programmes for DNA testing to assess the quality and standards of forensic laboratories. The foregoing analysis makes it clear that there should be universal standards of laboratories for laboratory procedures as well as for interpretation of statistical analysis of DNA test results. The laboratories often conduct DNA testing in violation of standardised scientific protocols and without following established procedures. The scientists conducting DNA testing should be trained from time to time and their reports should also be revaluated.

It must be checked before reception of DNA evidence whether the DNA testing has applied the theory and technique certified by scientific community as valid. The court often employs an independent third person to evaluate the procedures adopted by forensic laboratories. Courts must employ extra caution while selecting a person who can critically evaluate in a court of law the theories and techniques for DNA. The person who is called upon by court to check the reliability of particular methods for DNA, he must be a member of that specific forensic community in which that theory or technique belongs because a non member or unconnected person to that scientific forum will not be able to draw appropriate conclusions. The qualifications, practical experience and special knowledge must be considered as relevant factors during the selection of a DNA expert.

The criminal trial demands forensic understanding. The broad scientific education programmes for the lawyers and judges must be made mandatory to understand the forensic case assessment and interpretation. The systematic education programmes will help to elucidate the general questions, concepts and issues affecting DNA evidence.

The main focus of DNA profiling at international level must be towards:

1. To increase the research and development of new DNA testing technologies.
2. To expand the Combined DNA Index System (CODIS).
3. To eliminate the substantial backlog of DNA samples collected from crime scenes and convicted offenders.
4. To improve and expand DNA testing capacity of Central, State and local crime laboratories.
5. To develop new training programs for the collection and usage of DNA evidence.
6. To provide post-conviction DNA testing and the preservation of biological evidence.
7. To establish effective mechanism to enforce rights and responsibilities across Nations.

There is hardly any investigating officer or Court in a country who has not heard about the potential value of DNA. The judicial acceptance of DNA evidence depends upon the recognition it receives in the scientific field. The administration of criminal justice system demands that a criminal case should be investigated with great forensic understanding and the criminal should be identified and convicted properly.

Conclusion

DNA is a science to study genetic differences. DNA can be obtained from every part of the body i.e hair, semen, saliva, blood, urine etc.DNA is unchangeable, non replaceable and can produce high degree of accurate results without any partiality. Since every crime leaves a trace, DNA has become an integral part of criminal justice system. The advent of DNA techniques like RFLP, PCR, STR and mtDNA have high power to differentiate one person from another and has increased its efficacy. The small,

insufficient or degraded biological material can be successfullyanalysed through abovementioned DNA techniques. In criminal trials DNA evidence is useful where the identity of the culprit is awaited especially in homicidal, rape and murder cases. No other scientific evidence is so clinching as DNA. DNA is always same within the family members hence it is possible to identify the culprit by analysing the DNA of the close family members. DNA evidence based trials have a history of misunderstandings because judges do not admit scientific evidence at its face value. The proliferation of cases involving DNA evidence brings the criminal justice system with new problems connected with the evaluation of such evidence. The major question needs to be answered in this area is that whether the DNA procedure is being regulated and scrutinised by law enforcement agencies because it can adversely affect the civil liberties of an individual. The proper understanding of DNA evidence will be helpful to the legal system in determination of facts in issue.The DNA evidence has now emerged as a new tool for identification of individuals. It is worthwhile to quote what Benjamin Cardozo[26] has said long time ago that "*the inn that shelters for the night is not the end of the journey. Law like the traveller must be ready for tomorrow.*" The DNA technique is like a new star in the legal universe and its value must be recognised today before it is too late for tomorrow.

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