DNA Evidence, its Admissibility, and Its Impact on Criminal Trials: A Comparative Study

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I. Introduction:

Over the last decade, there has been an increase in the use of DNA evidence for the purpose of criminal trials throughout the world. With the advancement of science and technology, come more sophisticated methods of collecting and analyzing evidence, for the purpose of criminal trials. Therefore, in light of such advancement, especially with reference to DNA Evidence, this article intends to through light on the admissibility of such evidence in various courts across the world. The purpose of this article is purely to see as to what extent such evidence has been dealt with by the court of law. Although the Article has dealt with certain problems associated with DNA Testing, it is not the intention of the author to take a position either for or against such evidence.

The Article is divided into three parts. Part I deals with the meaning of DNA and the various techniques associated with the use of DNA in forensics. Part II, which is divided into three parts, deals with the various legal positions vis-à-vis DNA evidence in USA, UK and India. Part III deals with the problems associated with DNA Testing followed by a conclusion of the author in Part IV.

II. PART I:

1. WHAT IS DNA?

DNA is the genetic material that functions as a blueprint for the body. Whether someone will be short or tall, have blue or brown eyes, or be of Hispanic or Asian appearance is

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determined by their DNA, half of which is inherited from their father and half from their mother. Almost every cell in the body contains the same content of DNA.[2]

DNA is a double helix, a structure that resembles a ladder twisted around itself to form a spiral.[3] A strand of DNA is composed of a phosphate-sugar backbone and four types of nucleotide bases: guanine (G), cytosine (C), adenine (A), and thymine (T). These bases bond together to hold the strands of DNA together in the double helix; this bonding occurs only between cytosine and guanine or between adenine and thymine. There are approximately three billion of these base pairs of DNA in the nucleus of a human cell. In the nucleus, the DNA double helices are organized into chromosomes, of which humans have forty-six. Each chromosome is composed of genes, functional units of DNA that encode a particular trait.[4] The primary function of DNA is as genetic material-it encodes and transmits heritable traits from parent to offspring. Almost every cell in the body contains the same DNA, thus most tissue samples left at a crime scene will contain the perpetrator's DNA.[5] DNA however, is generally identical and it is extremely difficult to differentiate between the DNA of one individual from another. 99.0% to 99.9% of DNA is identical from one person to the next.[6] It is generally agreed, however, that everyone's DNA sequence, with the exception of identical twins, is unique only if all three billion base pairs of strains are examined.[7]

2. USE OF DNA IN FORENSICS

It is not possible for forensics experts to examine all three billion pairs. Therefore, they limit their examination to a limited region of DNA containing a few thousands of the three billion base pairs.[8]

FINDING A MATCH

[2] Richard A. Nakashima, *DNA Evidence in Criminal Trials: A Defense Attorney's Primer*, Nebraska Law Review, Vol. 74, 1995 p. 445
[3] *Ibid*
[4] Veronica Valdivieso, *DNA Warrants: A Panacea for Old, Cold Rape Cases?* Georgetown Law Journal, Vol. 90, 2001-2002, p. 1013
[5] *Ibid*
[6] Sue Rosenthal, *My Brother's Keeper.- A Challenge to the Probative Value of DNA Fingerprinting,* American Journal of Criminal Law Vol. 23 1995 p. 195
[7] Nakashima, *supra* note 1, at 446.
[8] *ibid*

Each of these regions represents a particular location on a specific chromosome. Individually, each region is called a locus (the plural form is "loci"). In a forensic DNA typing experiment, four or five different loci would be compared between a suspect's DNA and a crime scene DNA sample to see whether or not they match. If a match is observed, *this indicates, but does not prove*, that the suspect could have left that DNA sample at the crime scene, and therefore could have committed the crime. Alternatively, if no match is observed, this rules out the suspect as the source of that particular DNA sample.

TECHNIQUES OF FORENSIC ANALYSIS

The one most commonly used is **restriction fragment length polymorphism (RFLP) analysis**. It has its advantages as well as disadvantages. The biggest disadvantage is the vulnerability of the system towards contamination. The large majority of criminal trials where **DNA** evidence has been introduced have involved RFLP analysis.[9]

The second type of fingerprinting procedure is **polymerase chain reaction** (**PCR**). PCR, an alternative to RFLP analysis used only when RFLP cannot be performed. PCR amplification can be used on much smaller DNA samples, but it is more sensitive to sample contamination. If there is sufficient intact DNA, the RFLP method is preferred because it is more useful, with each fingerprint occurring only in one person in every one hundred thousand to one hundred million.[10] If the forensic sample is too miniscule for RFLP testing, or if the DNA has degraded because of exposure to sunlight, high temperatures, or excess humidity, DNA analysis with the aid of PCR may be useful.

III. PART II:

A. LEGAL POSITION IN U.S.A.

The use of DNA in criminal investigation has been very successful in counties like USA. The development of an advanced Federal DNA Data Base has met with much success throughout the country. However, the debate on DNA Data Bases will not be considered for the purpose of

[9] *Ibid* p. 447
[10] Valdivieso, *supra note 3*, p. 1016

this article. This article primarily focuses on the admissibility of such kind of evidence in the courts of law during the process of criminal trials. However, it is important to give a brief background on DNA Data Bases in the USA and the various related legislative provisions governing DNA profiling.

Combined DNA Index System (CODIS)

CODIS, the FBI's Combined DNA Index System, is a law enforcement tool used to link DNA from an unknown perpetrator to an identifiable suspect. CODIS is essentially a registry of DNA samples from known individuals organized into a detailed database with which DNA collected from crime scenes, unidentified human remains, and crime victims can be compared. Profiles obtained from convicted offenders can be linked together with profiles collected from crime scenes to identify a perpetrator who has left biological evidence at a crime scene. Any DNA match generated by the database gives law enforcement probable cause to bring the offender into custody and obtain a confirmatory DNA sample.[11] The CODIS program is a direct result of the **DNA Identification Act of 1994**, which authorizes the Attorney General of the United States to grant money to states for the development of DNA collection systems. The DNA Identification Act of 1994, allocates funds to those states that collect, at a minimum, DNA samples from felony sex offenders and subsequently organize those samples into their own state database systems. In addition the DNA Identification Act of 1994 requires each state to link its DNA database to the FBI's records in an effort to create one nationwide database.[12]

In 2000, CODIS began to be systematically and reliably filled with DNA fingerprint data from qualifying convicts upon the enactment of the **DNA Analysis Backlog Elimination Act** ("Backlog Act"). The Backlog Act "authorize[d] a new program of Federal assistance to States to enable them to clear their backlogs of DNA samples ... [and to] fill a gap in the system by authorizing collection, analysis, and indexing of DNA samples from persons convicted of Federal crimes.[13] Under the Backlog Act, individuals convicted for murder, manslaughter, sexual abuse, child abuse, kidnapping, robbery, burglary, or any attempt or conspiracy to commit such

[11] Kimberly A. Polanco, *Constitutional Law-The Fourth Amendment Challenge To DNA Sampling Of Arrestees Pursuant To The Justice For All Act Of 2004: A Proposed Modification To The Traditional Fourth Amendment Test Of Reasonableness*. University of Arkansas Law Review, Vol. 27 2004-2005 p. 488
[12] *Ibid*
[13] Patrick Haines, *Embracing The DNA Fingerprint Act* Journal on Telecomm. & High Technology Law, Vol. 5 2006-2007 p. 633

crimes, would be compelled to submit a DNA sample to CODIS. All fifty states followed suit, enacting their own statutes requiring criminals to provide DNA to CODIS upon conviction of a qualifying crime. Later, federal legislation added all violent crimes and terrorism to the qualifying list. In practice, CODIS is maintained by the Federal Bureau of Investigation.[14]

The DNA Fingerprint Act of 2005 came into force on January 5, 2006. The Act authorizes, *inter alia*, collection of DNA samples from persons arrested or detained under federal authority for inclusion in CODIS.[15] At least four states have already passed "sample on arrest" laws, and it is likely that other states will adopt similar legislation now that the Act is federal law.[16]

Standards laid down by the Courts for the Admissibility of DNA Evidence

The standards of DNA evidence differ from state to state on a case to case basis. However, majority of the Courts have followed certain standards of admissibility by relying on certain judicial precedents as well as the Federal Rules of Evidence. The **Federal Rules of Evidence** were established to "create a uniform standard of admissibility of evidence." For cases involving scientific evidence, the federal rules have greatly expanded the trial judge's "gate-keeping" role. Rule 104(a) adds to this role by providing the trial judge with the authority not only to determine the admissibility of evidence but also to address preliminary issues concerning the qualifications of proposed witnesses.[17] Rule 402 sets forth the requirement that evidence be relevant in order to be admitted.'" Rules 403 and 702 in particular have affected admissibility of DNA-providing much greater judicial discretion.' Federal Rule 702 allows the trial judge to decide whether testimony is necessary to understand the evidence or to resolve an issue of

[14] *Ibid*
[15] *Id* p. 645
[16] These states are California, Nebraska, New Jersey, Texas.
[17] FED. R. EVID. 104(a) ("Preliminary questions concerning the qualification of a person to be a witness, the existence of a privilege, or the admissibility of evidence shall be determined by the court.") retrieved from (http://www.law.cornell.edu/rules/fre/) on 16-10-2012

fact."[18] Rule 403 allows the judge to exclude relevant evidence if he or she finds that the probative value of the evidence substantially outweighs its prejudicial effect.[19]

The various **Judicial Standards** which have been laid down by the courts are as follows:

In ***Frye v. United States*** the court denied admissibility of the results of a systolic blood pressure deception test (lie detector test) based on a "general acceptance" standard. This standard established that in order for a new scientific principle or test to be admitted into evidence, it must **"'be sufficiently established to have gained general acceptance' within the relevant scientific community."** The court found that this lie detector test failed under the standard because it had not yet been sufficiently recognized by scientists to justify allowing expert testimony based on the technique.[20]

In ***People v. Kelly***, California Supreme Court adopted a modified *Frye* standard. *In Kelly*, the court was faced with the task of deciding the admissibility of "voice print" identification evidence. Under the new standard, for a new scientific principle or technique to be admitted into evidence, it must pass a three part test. **First**, the proponent of the evidence must establish that the underlying theory is reliable. **Second**, the witness testifying "must be properly qualified as an expert to give an opinion on the subject."' **Lastly**, the proponent must show that the correct scientific procedures were used and that they are generally accepted in the scientific community.

In ***Daubert v. Merrell Dow Pharmaceuticals, Inc.***, the United States Supreme Court held that the relevancy test set forth in *Federal Rules of Evidence* Rule 702 superseded the standard established in *Frye.* In determining the admissibility of expert testimony based upon novel scientific evidence, the *Daubert* Court suggested four factors for consideration: 1) whether the theory or technique in question can be (and has been) tested; 2) whether it has been subjected to peer review and publication; 3) its known or potential error rate and the existence and

[18] FED. R. EVID. 702 ("If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.") retrieved from (http://www.law.cornell.edu/rules/fre/) on 16-10-2012

[19] The court may exclude relevant evidence if its probative value is substantially outweighed by a danger of one or more of the following: unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence. retrieved from (http://www.law.cornell.edu/rules/fre/) on 16-10-2012

[20] Kristen Bolden, *DNA Fabrication, A Wake Up Call: The Need To Reevaluate The Admissibility And Reliability Of DNA Evidence*, Georgia State University Law Review, Vol. 27 2010-2011 pp. 420-421

maintenance of standards controlling its operation; and 4) whether it has attracted widespread acceptance within a relevant scientific community.[21]

Use of the standards by the Courts

The Supreme Courts of Alaska, Colorado, Florida, New York and Washington have held that the Frye standard is still to be used to determine the admissibility of novel scientific evidence (including DNA typing) in their jurisdictions. A number of states, including Delaware, Indiana, New Mexico, Oregon, and Wyoming, have applied a relevancy standard like *Daubert* to the admissibility of DNA evidence in their courts. Several states, including Arizona, Illinois, Minnesota and Pennsylvania, have continued to use the *Frye* test because their supreme courts have not yet ruled upon whether the *Daubert* standard has superseded *Frye* in their jurisdictions.[22]

Fourth Amendment[23] Right

In ***Landry v. Attorney General***, a constitutional challenge to the involuntary collection of DNA samples from convicted felons was defeated. The Court held that collection of DNA samples in order to accurately establish the identity of criminals did not implicate the Fourth Amendment.[24] It is now also well settled that, on balance, the government's legitimate interest in an effective and accurate criminal justice system outweighs the diminished privacy rights of convicted felons, making collection of DNA samples from felons a minimal and constitutional intrusion.

B. LEGAL POSITION IN U.K.

Dr. Alec Jeffreys, a British geneticist, discovered the technique of DNA profiling in 1985. Similar to Americans, English scientists, attorneys and courts embraced DNA testing with

[21] Nakashima, *supra* note1 p. 454
[22] *Ibid* p. 456
[23] The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.

[24] Bolden *Supra* note 19 p. 642

enthusiasm initially. The current standard for admitting expert testimony in English courts requires that relevant evidence be admitted unless there are strong countervailing reasons not to admit it.' English courts regularly admit expert testimony and rely on cross-examination techniques and opposing experts to reveal deficiencies in one expert's testimony.[25]The English justice system does not require a preliminary hearing by the judge to determine whether the correct procedures were followed by the testing lab.[26]

England should adopt a more stringent standard regarding the admissibility of expert testimony, similar to that imposed under *Daubert* in the United States, to ensure the relevance and reliability of proposed expert testimony about DNA profiling.[27] In recent years, the Court of Appeals (Criminal Division) in England has overturned four convictions based on DNA evidence. Two of these cases were overturned based upon the statistical evidence presented to the jury. In the *Gordon*[28] case, the Lordships decided the evidence "raised some arguable questions on whether the match probabilities put to the jury and summed up to them by the judge could properly be sustained." The Court of Appeals decided the case should be retried based on additional evidence from an expert who criticized the measurements used by Cellmark Diagnostic Laboratories in determining whether or not a match existed.[29]

C. LEGAL POSITION IN INDIA

The Law Commission of India in its185th Report on Review of the Indian Evidence Act, 1872[30] made several references to DNA testing. Regarding the refusal of a person to undergo blood tests or a DNA test in criminal cases, the Commission opined, “we do not again think that any special provision is to be made in sec. 9 of the Evidence Act, 1872. The Courts can, in criminal or civil cases, always rely upon a person’s conduct under sec. 9 and no special provision

[25] Jennifer Callahan, *The Admissibility Of DNA Evidence In The United States And England* Suffolk Transnational Law Review, Vol. 19 1995-1996 p.550
[26] *Ibid*
[27] *Id.* p. 554-555
[28] David Foskett, *Law - Can We Trust DNA?*, THE TIMES, May 31, 1994 (discussing recent attack on population genetics statistical evidence presented to jury); David Utting, *Wonder Test That May Prove Fallible – Legal World Questions DNA Evidence*, GUARDIAN, Jan. 8, 1992, at 21 (describing controversy over the reliability of DNA profiling in England). Cited in *id* p. 551-552
[29] *Id.* P. 551-552
[30] http://lawcommissionofindia.nic.in/reports.htm retrieved on 17-10-12 at 08:10 am

is necessary in sec. 9 of the Evidence Act.[31]…We have however recommended that so far as refusal by a man for undergoing blood tests or DNA test, for purposes of proving paternity, is concerned, that he should be deemed as having waived his defense that he is not the father."[32] This distinction seems to have been adopted by the Supreme Court in ***Selvi v. State of Karnataka***[33] in which the court upheld the authority of Civil Court to order a medical examination in exercise of the inherent powers vested in it by Section 151 of the CPC, while holding that the same reasoning cannot be applied in the criminal context.[34] It was also held that compelled extraction of blood samples in the course of a medical examination does not amount to "conduct that shocks the conscience" and that "use of force as may be reasonably necessary is mandated by law and hence it meets the threshold of procedure established by law".[35] Therefore, the Court was clear to made a distinction between civil and criminal cases. This distinction has been further adopted by the Delhi High Court in ***Rohit Shekar v. N.D. Tiwari***[36] in which the court while relying on *Selvi* compelled the respondent to give a blood sample for DNA testing to ascertain the paternity of the Appellant.[37]

For the purpose of criminal cases, the legislature also proposes to introduce a DNA Profiling Bill. This bill was prepared in 2007 by Centre for DNA Fingerprinting and Diagnostics, with the objective of regulating the use of DNA for forensic and other purposes.[38] The bill was again redrafted and prepared by the Department of Biotechnology in February 2012 and another working draft was created in April 2012. [39] Since there have been numerous drafts of the bill, it would not be appropriate to comment on the features on any of the bills until it is introduced in Parliament.

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[31] http://lawcommissionofindia.nic.in/reports/185thReport-PartII.pdf retrieved on 17-10-12 at 8.15 am Part II Chapter 1 p. 53

[32] *Ibid*

[33] http://indiankanoon.org/doc/338008/ retrieved on 15-10-12 at 8.45am. *See also* (2010) 7 SCC 263

[34] *Ibid* para 175

[35] *Id* para 203

[36] http://lobis.nic.in/dhc/RSE/judgement/27-04-2012/RSE27042012FAOOS5472011.pdf retrieved on 14-10-12 at 4.30 pm

[37] The Court in para 36 directed the single judge to use reasonable force if the Respondent did not cooperate. Besides *Selvi*, the Court relied on several judgments such as ***Sharda v. Dharmpal*** AIR 2003 SC 3450 and ***Bhabani Prasad Jena v. Convenor Secretary, Orissa State Commission for Women*** AIR 2010 SC 2851. *See generally* para 9 to 15.The Apex Court undoubtedly in ***Sharda*** (supra) has held that "if despite an order passed by the Court, a person refuses to submit himself to such medical examination, a strong case for drawing an adverse inference" within the meaning of Section 114 of the Evidence Act would be made out.(para 13)

[38] http://cis-india.org/internet-governance/blog/draft-human-dna-profiling-bill-april-2012 retrieved on 24-03-13 at 10:10pm

[39] *Ibid*

IV. PART III:

PROBLEMS WITH DNA TESTING

There are several problems during the process of conducting DNA testing. With the increase in science and technology, there is great **scope for manipulations** in order to get desired results. This has been proved by a recent study conducted by Israeli scientists in June 2009. The researchers asserted that anyone with the proper equipment and basic understanding of molecular biology could create artificial DNA in virtually unending amounts.[40] Moreover, there is also the possibility of **human error** in collecting, analyzing, and cataloging DNA samples coupled with the lack of **proper infrastructure, poor management, budget shortages, and corruption within crime labs**.[41] This is a problem which is faced in many countries across the world including India[42]. The **quality of the sample** also plays a very important role in carrying out an analysis.[43] Degradation of a sample due to sunlight, temperature, lack of proper storage, lack of proper handling at the crime scene, it likely to produce inaccurate results.

V. Conclusion:

The debate surrounding the admissibility of DNA evidence is likely to continue with the advancement of science and technology. The law in countries like USA has developed through both legislation and precedent. However, it will be remained to be seen as to what the future hold for countries like India, who are through legislation attempting to make a central DNA data base for the purpose of criminal investigations. *Prima facie*, the future of such ambitious plans appear to be bleak, if one were to analyze *Selvi*, which clearly disapproves collection of samples forcibly. Therefore, it would be wise for the legislature and the judiciary to touch base on certain aspects regarding the admissibility of such type of evidence, so that the benefits of such technology, can be used for the greater good of society at large.

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[40] D. Frumkin et al., *Authentication of Forensic DNA Samples*, FORENSIC SCI. INT. GENET. 1, 1 (2009). The researchers, working for Israeli forensic science company Nucleix, Ltd., published an article in Forensic Science International: Genetics on their discovery of the ability to fabricate DNA. *Nucleix Researchers Discover DNA Evidence May Easily Be Falsified*, CN PUBLICATIONS, Aug. 17, 2009, http://cnpublications.net/2009/08/18/dna-evidence-may-be-falsified retrieved on 25-09-12 at 7.30 am

[41] Haines *supra* note 12 p. 639

[42] http://www.legallyindia.com/Blogs/Entry/dna-experts-deposition-and-evidence-needs-to-be-accurate

[43] Nakashima *Supra* note 1 p. 468