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EVALUATING THE LEGAL ASPECTS OF DNA PROFILING

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ABSTRACT

Locard's Exchange Principle suggests that whenever two individuals are in contact with each other their traces are mutually shared. Therefore, when one commits a crime it is believed that the traces of biological evidence like blood, semen, saliva, pubic hair are transferred directly or indirectly. The former is more potent than the latter as direct link can be established between the perpetrator and the crime. The possible outcomes of the DNA profiling depend on three possibilities- whether they are inclusive (two samples are indistinguishable), exclusive (two samples are dissimilar) or inconclusive (the data not in compliance with the conclusion). The objective of the research is to study the evolution of the DNA bills and other provisions which do not expressly support DNA profiling but is latent. The use of reasonable force, the value of expert opinion, Court's power to conduct tests without violating right to privacy and right against self-incrimination, the effect in property and paternity matters, criminal justice, consumer affairs, impact on trial, adverse inference taken by court on refusal of the tests, idea on non-access and questions put on legitimacy of a child are all discussed.

INTRODUCTION

In the 17th century Nehemiah Grew discovered the presence of ridges on the hands and feet, followed by similar findings of Francis Galton in 1892. The Henry's system of Fingerprint identification 1901 with a little set of drawbacks established the existence of fingerprint evidence in forensic science. In 1930, Karl Landsteiner found out the four types of blood groups based on certain factors but was not a conclusive determinant for a person's identity. Alec Jeffrey in 1985 while working on myoglobin gene in seals, discovered the repeating sections in DNA and also its radioactive probe. The conventional methods of identification like confessions, circumstantial evidence and eye witness have failed to reduce the low conviction rates, thereby DNA profiling is evolving to fill the gaps. With the Prisoner's Bill, 1920 the use of biometrics for identification of criminals became legal in India. There are various types of DNA profiling namely- Polymerase Chain Reaction (PCR), Restricted Fragment Length Polymorphism (RFLP), Variable Number Tandem Repeat (VNTR) and Short Tandem Repeat (STR). PCR is an ancillary procedure, RFLP shows coloured reaction in probe, VNTR can be used for paternity test and STR is also effective in case of damaged DNAs.

LITERATURE REVIEW

- J. D. Watson & F. H. C. Crick¹-The Watson and Crick model suggests that Deoxyribonucleic Acid has double helix structure consisting the deoxyribose sugar, phosphate backbone and a nucleic acid base pair linked to a hydrogen bond. DNA molecule has purine (adenine and guanine) and pyrimidine (thymine and cytosine) which pair with each other.
- Joseph L. Peterson & Anna S. Legget²- Ever since 1970s, the field of forensic science has been revolutionized for identification of DNA patterns. Using different biological evidence such as semen, saliva, hair etc a person can be exculpated or inculpated or even establish paternity during a dispute.
- Wilson Wall³- Reliability on DNA is due to the fact that a minute or degraded part can be used to identify a person for example fifty micro litre of blood, hair sample with root intact or even ten micro litres of semen. The same genotype is constant throughout the body of an individual. No two individuals have similar base pair arrangements in DNA strands.
- David T. MacLaughlin & Patricia K. Donahoe⁴- During crime scene investigation, sex of an individual can be determined by taking the fact that males have XY chromosomes and females have XX chromosomes.

ANALYSIS

SUGGESTIONS GIVEN BY MALIMATH COMMITTEE

- It was proposed that if in case an accused fails to provide relevant information, then the law enforcers can conduct DNA test against him by amending Section 313 of the Criminal Procedure Code, 1973.

¹ A Structure for Deoxyribose Nucleic Acid, (Nature (3) 1953), pp.171, 737-738.

² The Evolution of Forensic Science: Progress Amid the Pitfalls, 36 Stetson L.Rev. 621, 622 (2007).

³ GENETICS AND DNA TECHNOLOGY: LEGAL ASPECTS, (2nd ed. 2004), pp. 24-25.

⁴ Sex Determination and Differentiation, N Engl J Med, 350, 367-378 (2004).

- A law giving guidelines to the police for setting uniform levels of checks and balances with obtaining genetic information and prevention of its misuse.
- To counter terrorism and hardened criminals, a national DNA database should be created.
- To get timely reports, well equipped laboratories and suitable infrastructure should be available to hold DNA samples and evidence.
- Public awareness should be given to all general public, prosecutors, police and judges.

NEED FOR DNA LEGISLATION

The admissibility of DNA evidence can be found in the form of expert opinion under Section 45 of the Indian Evidence Act, 1872. Along with the recommendations of the 185th Law Commission report, the 2003 amendment to the Indian Evidence Act included DNA tests in paternity dispute. The Criminal Procedure Code, 1973 does not specifically mention DNA analysis but its Section 53 does provide for medical examination of the accused when requested by the police and in Section 54 when requested by the arrested person. Section 164-A of Criminal Procedure Code states the rules for medical examination of accused and victim in sexual assault cases. Section 53 A of Cr. PC was amended in 2005 to allow investigating officers to collect DNA evidence with the help of an authorised medical practitioner. A use of reasonable amount force is applicable for example while collecting blood samples and does not violate the constitutional protection against self-incrimination given under Article 20 (3) and also under Section 161 (2) of the Criminal Procedure Code. Right to Privacy under Right to life and Personal Liberty under Article 21 of the Constitution is also applicable while facing some challenges. DNA Profiling Bill 2006 was amended in 2007, and then in 2015. The 271st Law Commission called it the DNA Based Technology (Use and Regulation) Bill, 2017 which was further expanded in 2018, 2019 and 2020.

- ***DNA Profiling Bill 2007***
 - ✓ A DNA test is not completely reliable as it can be compromised under certain circumstances, can be prone to degradation and also false implication. Therefore, the bill should allow procedures for complement it with supporting evidence in front of the court.
 - ✓ The scope of the DNA collection is extended to individuals who are not part of the crime scenes, who are neither victims nor criminals. Under Section 13 (xxii), the list can be further expanded by the DNA Board. Sometimes the misuse of this wide and vague ambit

where people are tested without conviction, invasion to various thresholds of privacy occurs.

- ✓ Apart from the list of offences and situations, the ` bill needs to have a clear provision as to when exactly the DNA samples can be collected like on arrest or charge, degree of relevance to the offence and its deciding parties-police or other mechanisms.⁵
- ✓ Section (1) (xv)-(xvi) of the Bill enables the board with dissemination, security, credibility, destruction of information and confidentiality which should be embedded in the bill itself.
- ✓ Section 19 laying out the obligations of the DNA laboratories should include privacy policy.
- ✓ The storage of the DNA samples under the bill is a wide reservoir of genetic information. After identification purpose is fulfilled the samples should be destroyed after a quality assurance period of 6 months to ensure privacy protection. Missing person's database and Criminal databases should be kept separate. The DNA profiles of convicted people can be sustained in cases of repetition of offences but that of victims and volunteers should be erased once an investigation is complete.
- ✓ Section 14 of the Bill suggests that the laboratories can carry out DNA procedures with the prior approval of the board in writing, whereas in Section 15 (2) contradicts the previous section by eradicating the laboratories need of prior approval from the board.
- ✓ The Data Bank Manager under Article 41 has been given too much of a discretion as to who may have access to the database where it should be strictly restricted to trained personnel for security clearance.
- ✓ Section 45 provides for penalties regarding destruction, tampering, disclosure and unauthorized access but none for illegal collection of DNA samples.
- ✓ The Bill should enable the individuals to press charges against misuse of data in courts rather than just limiting it to the Central government and the board under its Section 49 (1).
- ✓ The outsourcing of duties by the Board to committee members under Section 52 (2) should be restricted to administrative and other ancillary functions.
- ✓ The Bill rather than granting access to law enforcement agencies under Section 13 (x), Section (2) should facilitate the intermediary role of a Data Bank Manager to approve requests sent for matches.

⁵ Adhikari, Jyotirmoy. DNA Technology in Administration of Justice. Lexis Nexis. 2007, p-291.

- ✓ Section 17 (2) allows the operation of certain laboratories at the behest of the board for public interest even if they had violated some procedures.
- ✓ Section 22 of the Bill holds the laboratories responsible reducing the risk of contamination which should be increased to full liability so that it becomes easier for individuals to press charges.
- ✓ Section 28 provides for auditing of the DNA laboratories which should be imposed on the board as well for annual audits.
- ✓ Section 33 (4), (5) provides for setting up of indices by the DNA data bank holding identification records and DNA analysis as specified by regulations.
- ✓ Section 35 permits sharing of profiles along with foreign states through an approval of the Central government which should be kept to comparison only.
- ✓ Access of data banks for administration purposes under Section 39 needs further clarification.
- ✓ Section 36 (3) for removal of records of individuals proved to be innocent should be via legal mechanism for example reporting by the board.
- ✓ A individual should be given access to one's own DNA profile for details being held on police databases.
- ✓ Section 33 (6) stating the relation of DNA profiles and identity of a person needs more clear definition and should not include identity numbers.
- ✓ Section 13 of the bill needs more transparency with respect to powers and functions of the board,
- ✓ Section 39 (1) permitting DNA database to be used beyond the identification of the perpetrator should not be encouraged.
- ✓ DNA board should publish the probability of errors with respect to false matches and also the cost analysis.
- ***DNA Technology (Use and Regulation) Bill, 2017***

It wants to constitute a DNA profiling board which will be responsible for supervising DNA laboratories and data banks. It proposes to have both National and regional DNA data banks for states which will be accredited. The tests will be used solely for the purpose of identification and no bodily substances will be taken without the person's consent. The defaulters of the provision would be liable for fine and imprisonment up to three years.

- ***DNA Technology (Use and Application) Regulation Bill, 2018***

In its first part, it has given the reasons for collection of DNA data. The second part deals with privacy concerns of an individual, where Chapter VI read with chapter VIII of the bill imposes a duty on the information holders failing which they would face penal consequences. Consent from the accused for offence punishable with more than seven years is not required by the authorities. The third part talks of Regulatory mechanism and creation of a board with 13 members determined by the Schedule in the Bill.

JUDICIAL RESPONSE

- ***Cases related to paternity and maintenance-***

In a case under Section 125 of the Criminal Procedure Code, the court held that the Indian courts cannot order blood tests as a matter of right to have a roving enquiry⁶ as it may have constitutional implications.⁷ There must be a strong prima facie evidence to establish that the husband had non-access under Section 112 of the Evidence Act and no other supporting evidence would be helpful.⁸ The consequences should not result in labelling derogatory remarks for the mother and the child.⁹ It also stated that no-one can be compelled for giving a blood test.¹⁰ With regards to DNA test conducted on the foetus of the rape victim, the court held that a woman cannot be forced to give blood sample and no negative inference would be taken for her refusal.¹¹ It was held that when the parentage of a child is contradicting the grant for maintenance, parties agreeing for DNA test does not amount to violation of rights.¹² Bombay High Court observed the limitations of blood group tests with being able to indicate only possibilities and not paternity.¹³ Refusal to undergo DNA test in case of preserved foetus would bar a party from challenging the child's paternity.¹⁴

- ***Indian Constitution and DNA***

⁶ Gautum Kundu v. State of West Bengal, AIR 1993 SC 2295.

⁷ Arukumar v. Turaka Kondalal, 1998 Cri. L.J. 4279.

⁸ Kamti Devi v. Posh Ram, AIR 2001 SC 2226.

⁹ Bharu Raj v. Sumesh Sachdeo, AIR 1986 AII 259.

¹⁰ Sajeera v. P.K. Salim, 2000 Cri L.J. 1208 (Ker).

¹¹ Geeta Daha v. NCT of Delhi, 1997 (1) JCC 101.

¹² Kanchan Bedi v. Gurpreet Singh Bedi, AIR 1993 SC 2295.

¹³ Raghunath v. Shardabhai, AIR 1986 Bombay 386.

¹⁴ Alika Khosla v. Thomas Mathew, (2002) 62 DRJ 851.

It was held that the court's order to conduct a DNA test would not be a violation of fundamental rights like Article 21 and 20(3) or Section 114 of the Indian Evidence Act or Section 53, 173 (8) of the Code of Criminal Procedure Code.¹⁵ In criminal cases biological evidence helps in conviction as well as exoneration.¹⁶ In one case compulsion to medical examination was prohibited¹⁷ and in another was allowed.¹⁸

- ***Denial of DNA and its impact***

When a person or a party tries to refuse DNA test for personal interests on account of being violative of Article 21 of the Indian Constitution, it would be rejected.¹⁹ In a succession dispute with the use of DNA Test under Section 45 of Evidence Act, parentage of daughter under Section 372 of Indian Succession Act, 1925, the application set allowed by trial court was set aside by High Court to avoid violation of Article 20 (3) and Article 21.²⁰ But DNA test should be ordered only in deserving cases and not as a timely affair.²¹

- ***Refusal to undergo DNA test***

An adverse inference can be taken by the court for refusal to undergo DNA test.²² Unless and until the facts are clinching, tests should not be directed as it may result in branding the child as a bastard and a woman as immoral.²³ A negative inference drawn by the court should not prevent the acceptance of positive evidence.²⁴ Although the court has no power to direct the test but outright refusal may result in adverse inference by the Court.²⁵ Tempting inference is a presumption juris at de jure and is a little less of degree of "shall presume" under Section 3 of Indian Evidence Act.²⁶

- ***DNA and the Law of Evidence***

¹⁵ Vasu v. Santha, 1975 Ker LT 533.

¹⁶ K. Damayanti v. State of Orissa & Ors., 2004 Cr L J 4003 (Ori).

¹⁷ Bipin Chandra Shantilal Bhatt v. Madhuriben Bhat, AIR 1963 Guj. 250.

¹⁸ Najabhai v. State of Gujarat, ST1972 Cr LJ 1605.

¹⁹ Sharada v. Dharampal, AIR 1999 SC 495.

²⁰ Banarsi Das v. Mrs. Teeku Dutta & Ors., 2005 (52) A Cri C 481 SC.

²¹ Komti Devi v. Poshiram, 2001 (5) SCC 311.

²² Dwarika Prasad Satpathy v. Bidyut Prava Dixit, AIR 1999 SC 3348.

²³ Smt. Dukhar Jahan, AIR 1987 SC 1049.

²⁴ Subayya Gounder v. Bhoopala Subhramaniam, AIR 1959 Madras 396.

²⁵ K Selvaraj v. P. Jayakumari, 2000 Cri LJ 4748 (Ker).

²⁶ Baldev Raj Meghani v. Urmila Meghani, AIR 1979 SC 879.

It was observed that DNA evidence is generally accepted by the scientific community as reliable and the testing procedure is reliable if performed properly. Statement of rape victims require no corroboration as it is provided by the medical reports.²⁷

- ***DNA and the Law of Crimes***

While a suspect agrees to volunteer for a blood test and a DNA analysis and he subsequently refuses, the CBI cannot take the help of Section 166-B, Criminal Procedure Code.²⁸ Expert evidence and death penalty can be admitted as constitutional.²⁹ DNA evidence can be brought in front of a court to prove rape of a deceased person.³⁰ Admissibility of expert evidence under Section 45 of the Indian Evidence Act and Certain provisions of the Indian Penal Code and Arms Act were scrutinized minutely while conducting DNA test and maintaining its quality³¹. Questions of whether an investigating authority could conduct a DNA test in the absence of a special enactments but it was settled that the Court cannot interfere with the investigation.³²

- ***Malpractices and scientific process***

The accused was acquitted by the court on the grounds that sufficient amount of molecular weight of DNA was not taken so as to make the test conclusive and credible.³³

- ***Compelled testimony and DNA***

No person can be compelled to give testimony through blood against his or her will³⁴ keeping in mind any provision which is ultra vires to the access to the justice.³⁵

²⁷ Kamalnath & Ors. v. State of Tamil Nadu, 2005 (4) SCJ 724 SC.

²⁸ Narinder Singh Bogarh v. State of Punjab, 2004 Cr LJ 1446 SC.

²⁹ Dharma Deo Yadav v. State of UP, 2005 (2) DNR (HC) 675.

³⁰ CBI v. Santosh Kumar Singh AIR 1994 SC 786.

³¹ Patangi Balrama Venkata Ganesh & Ors v. State of A.P., 2003 Cr LJ 4508 (A.P.).

³² Chandan Pannalal Jaiswal v. State of Gujarat, 2004 Cr LJ 2992.

³³ MV Mahesh v. State of Karnataka, 1996 Cri LJ 771.

³⁴ R.P. Uloganambi v. K.C. Loganayaki, 1986 Cri LJ 1552.

³⁵ State v. Sheshappa Dudhappa Tambade, AIR 1964 Bom. 253.

- ***Relevance of DNA in Civil Cases***

In the absence of any statutory law, the courts have adopted the trend that no party in civil cases can be compelled for blood group tests.³⁶

- ***Powers conferred upon Court and DNA***

Although there is no power conferred upon courts to take blood samples but it can be facilitated³⁷ through Section 53 and 54 of Criminal Procedure Code³⁸ and bringing Section 367 (1) and 482 of Cr. PC did not find the repulsion of the accused to be prominent while the process for establishing his guilt is underway. Medical examinations were not included within the scope of being a witness.³⁹ Matrimonial court's order to people for undergoing medical tests would not amount to violation of Article 21 of the Indian Constitution and adverse inference under Section 114 of the Evidence Act can be drawn by the court on refusal by the parties.

- ***DNA and Guardians and Wards Act, 1890***

A petitioner under the 1890 Act proved the respondent to be his father through a DNA test and maintenance was granted from the date of petition⁴⁰. In a case to prove the birth of a child during continuance of a valid marriage and applicability of Section 112 of Evidence Act, DNA test was asked for by the Court.⁴¹

- ***Consumer Protection Act, 1986 and DNA***

Complaint was made against AIIMS doctors for giving a wrong foetus diagnosis report and the error of 1-2% was not able to save the doctors from being liable for negligence. DNA test cannot evade the conclusiveness of Section 112 of Evidence Act.⁴²

³⁶ Krish Murthi Aiyer v. Govind Swami Palley, AIR 1996 Mad. 443.

³⁷ Hargovinda Soni v. Ram Dularey, AIR 1986 MP 57 (62).

³⁸ Ananth Kumar v. State, 1977 Cri LJ 1797.

³⁹ State of Bombay v. Kahthi Kalu, AIR 1961 SC 1809.234

⁴⁰ Anil Kumar v. Turaka Kondala Rao, 1998 Cr LJ 4279 (A.P.).

⁴¹ Shaikh Fakruddin v. Shaikh Mohammad Hassan & Ors, 2005 (4) CCC 522 (A.P.).

⁴² Abdul Salam v. Chalil Sajid & Ors, 2003 1 DMC 524.

- ***DNA and Termination of Pregnancy***

While asking for medical termination under the Section 3 and 4 of the 1971 Act and charges of rape under Section 376 of IPC, the victim asked for DNA test to help prove her case against the perpetrators.⁴³

- ***DNA and Rights to Privacy***

DNA test on the slides of a foetus already terminated was not a violation of right to privacy.⁴⁴ When there is a conflicting interest between right to privacy and duty of the court to find the truth, the latter stands out as was held in ND Tiwari paternity case.

COMPARATIVE ANALYSIS

- In UK- EDNAP and ENFSI were set up for the purpose of monitoring DNA profiling. There is no need for a special test and it should only meet the required standards of relevancy.⁴⁵ The relevant evidence is accepted by the court unless it is barred by public policy.⁴⁶
- In US- The DNA identification Act 1994, DNA analysis Backlog Elimination Act of 2000, Omnibus Crime Control and Safe Streets Act 1968 support the establishment National Forensic Science Commission and the NDNAD. The Court find it confusing whether the tests as admissible evidence is experimental or demonstrative.⁴⁷ The scientific community has accepted DNA profiling as a general principle.⁴⁸ Sometimes the reliability of the PCR was doubted discarding DNA evidence⁴⁹ on the basis of its risk of errors.⁵⁰ The generally

⁴³ D. Rajeswari v. State of Tamil Nadu & Ors, 1996 Cri LJ 3795 (Mad).

⁴⁴ Ms. X v. Mr. Z & Ors AIR 2002 Delhi 217

⁴⁵ R v. Das, (1986) 31 CCC 3d 353.

⁴⁶ R v Abbey, (1982) 68 CCC 2d 394.

⁴⁷ Frye v. United States, 293 F, 1013 (1923).

⁴⁸ State v. Woodall, 385 S.E. 2d 253 (W. Va 1989).

⁴⁹ People v. Martinez, C.S. No. 709321, (March 1989, Los Angeles Co. Ct).

⁵⁰ State v Schwartz, 447 N.W. 2d 422 (Minn SC 1989).

accepted standards of DNA tests were challenged by the federal evidence rules on reliability⁵¹ as a scientific evidence.⁵²

CONCLUSION AND SUGGESTIONS

There are certain benefits in DNA profiling where there are almost very high chances of accuracy in identifying crime suspects and test of reliability also supports it. Biological evidence is surpassing the traditional methods of identification. DNA tests can be performed on samples which have dried and aged whereas the old ways don't stand a chance. On the contrary some obstacles are also present where the Indian system lacks technology as compared to NDNAD, issues of contamination of samples may crop up, lack of infrastructure affecting efficiency of testing, non-availability of a secure e-DNA database.

The DNA legislation must ensure that- the evidence is being collected from the suspect only when there is a need and not as a matter of routine, that is there should be reasonable grounds and privacy concerns should be avoided when the duty of the court to reach the truth comes into play, eligibility of the scientists, offenses of felony and terrorism must mandate the tests, proper training of police officers, improvement in handling and storing the DNA samples along with its maintenance.

REFERENCES

ARTICLES

- 185th Report on Review of The Indian Evidence Act, 1872, Law Commission of India (2001) www.lawcommissionofindia.nic.in/reports/185thReport-PartI.pdf
- Arthur Jeffreys, V. Wilson & S.L. Thein, Individual specific fingerprints of human DNA, Nature 76 (1985).
- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts & Peter Walter, Molecular Biology of the Cell, (4th ed. New York: Garland Science; 2002) From DNA to RNA.

⁵¹ Daubert v. Merrel Dow Pharmaceuticals Inc. 509 U.S. 579 (1993).

⁵² Cella v. United States, 998 F. 2d 418 (7th Cir. 1993).

- Committee on Identifying the Needs of the Forensic Sciences Community, National Research Council, Strengthening Forensic Science in the United States: A Path Forward, (Aug 2009) <http://www.nap.edu/catalog/12589.html>
- David T. MacLaughlin & Patricia K. Donahoe, Sex Determination and Differentiation, *N Engl J Med*, 350, 367-378 (2004).
- Hans Peter Schwarz & Friedrich Dörner, Karl Landsteiner and his major contributions to haematology, 121(4) *BJH* 556, 560 (2003).
- J. D. Watson & F. H. C. Crick, A Structure for Deoxyribose Nucleic Acid, 171, 737-738 (*Nature* (3) 1953).
- Joseph L. Peterson & Anna S. Leggett, The Evolution of Forensic Science: Progress Amid the Pitfalls, 36 *Stetson L.Rev.* 621, 622 (2007).
- Katie Horsman, Joan Bienvenue, Kiev Blasier & James Landers, Forensic DNA Analysis on Microfluidic Devices: A Review, 52(4) *JFS* 784 (2007).
- Louis Robinson, An Ancient Reading of Finger-Prints, 180 *NAR* 727 (1905).

BOOKS

- Adhikari, Jyotirmoy. *DNA Technology in Administration of Justice*. Lexis Nexis. 2007, p-291.
- Ishita Chatterjee, *Law of Forensic Science*, (1st ed. 2015), p 739.
- M.S. Rao & B.P. Maithil, *Crime Scene Management: A Forensic Approach*, (2nd ed. 2013) p 338.
- Nehemiah Grew, *On the Pores in the Skin of the Hands and Feet*, (1753).
- Paul L. Kirk, *Crime investigation: physical evidence and the police laboratory* (2nd ed. 1974).
- Wilson Wall, *Genetics and DNA Technology: Legal Aspects*, (2nd ed. 2004), p 24-25.