



INTERNATIONAL JOURNAL OF HUMAN RIGHTS LAW REVIEW

An International Open Access Double Blind Peer Reviewed, Referred Journal

Volume 5 | Issue 4 | 2026

Art. 34

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Recommended Citation

Priyank Jagawanshi and Dr. Gurudev Sahil, *DNA Bank in the Scientific Era of Criminal Justice: A Futuristic Perspective with reference to Bioethics*, 5 IJHRLR 487-497 (2026).

Available at www.ijhrlr.in/current-issues/.

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DNA Bank in the Scientific Era of Criminal Justice: A Futuristic Perspective with reference to Bioethics

ABSTRACT

In the era of science and technology, one must adapt or streamline oneself with the development and progress. Criminal justice administration should also incorporate such scientific developments that may assist the judicial institutions in delivering justice efficiently, which is lacking at present due to numerous pending backlogs in the courts. This delay affects the judicial institutions negatively, where people losing trust and faith in these institutions. One remarkable scientific development in the field of forensic science has changed the investigation from traditional to scientific after the inclusion of DNA forensics. DNA forensic as a branch of the discipline of forensic science, has been impacting the investigations and trials positively where justice is delivered in time rather than relying on traditional method of testimonials recording. Criminal cases, those are based on biological evidences, such as sexual offences, murder, mob lynching, POCSO matters etc. can be effectively investigated for DNA evidence through scientific investigation. Recognition of DNA as an individualistic character is very well appreciated within scientific community without any reservations. A creation of a DNA bank will be an extraordinary scientific marvel that will not only assist the criminal justice but it will be helpful in the cases of unidentified bodies, exoneration of convicts, solving paternity disputes etc. against the testimonial evidence. Bioethics brings the balancing between usage of genetic science to not violate any moral values or rights. DNA evidence, if found shall be treated substantially rather than appreciating testimonial evidence which can be faked in the court during trial. This Paper will highlight the importance of DNA bank in the field of criminal justice. It also discuss the constitutional and data privacy concerns associated with DNA evidence collections in the light of Bioethics.

KEYWORDS

DNA Evidence, Criminal Justice, Forensic Science, DNA Bank, Bioethics

I. INTRODUCTION

In the era of science and technology, DNA evidence is one of sought after evidence that can establish the identity of the person concerned. Indian criminal justice administration has a backlog of numerous cases that will take years to reach conclusion. Police relying on the traditional method of investigation and Courts relying on the traditional method of trial lead to an indefinite delay in the trial. In the pace of scientific development, Indian criminal justice administration shall adopt certain practices that will enable them to conclude a criminal case. Investigation is still done with traditional approach, where more reliance will be on the testimonial evidences. Testimonial evidence has own limitations. Witness coming for giving testimonial evidence have been submitting false statements in the court, in some case, witnesses are turning hostile. In those cases it becomes very difficult for the court to determine the case. Due to several hindrances associated with the witness testimony. But due to lack of scientific temperament, investigation is not occurring scientifically. A scientific investigation will reduce the latency and increase the reliability of the evidence collected. DNA evidence is one of a kind of evidence that follows scientific principles i.e. no two people can have the same DNA except identical twins. Second, DNA offender databases can be effective and legitimate tools for solving and preventing crimes.¹ Such an individualistic character of the DNA evidence can be incorporated within the investigation. A biological trace collected from the crime scene generated the DNA. Since the discovery of DNA fingerprinting technology in 1985 it has been used extensively as evidence in the court of law world-wide to establish the individual identity both in civil and criminal matters.² Once the collected DNA from those biological traces matches with the potential offender's DNA, a presumption can be construed that such potential suspects have a kind of connection to the crime scene from where such biological traces have been collected.

This study proposes the framing of a legal and institutional framework for the DNA bank in India, along with certain guiding principles balancing bioethics concerns. This study will cover the basic foundations for the creation of a DNA bank that will assist the criminal justice administration. It will highlight the effective mechanism of the DNA bank in investigation and during trial. DNA bank requires certain standard operating protocols for making it more accurate, reliable and authentic. DNA analysis, as part of forensic investigation, has transformed the criminal justice system by providing highly accurate

¹ DAVID LAZER, MICHELLE N. MEYER, *DNA AND THE CRIMINAL JUSTICE SYSTEM: CONSENSUS AND DEBATE*, 2004

² S. K. Verma, G. K. Goswami, *DNA evidence: current perspective and future challenges in India*, FORENSIC SCIENCE INTERNATIONAL (2014)

evidence to link individuals to crime scenes, thereby enhancing forensic reliability while also increasing public trust in the system.³

II. DNA EVIDENCE IN CRIMINAL JUSTICE

DNA is one of the strongest evidence if collected and analysed properly, without any error, will lead to a conclusive result that will assist the criminal justice administration. DNA was first discovered by Alec Jeffery, who had also used DNA in a criminal case.⁴ DNA was first and foremost discovered by a young Swiss scientist named Friedrich Miescher by isolating some substances from the nuclei of the cells later on to be known as nucleic acid in 1860s.⁵ Later on James Watson, a biologist and Francis Crick, a physicist gave the structure of DNA as three-dimensional double helix. Afterwards several researches have been conducted in the field of DNA.⁶ In India, Lalji was one of the pioneer who had used DNA for the identification in a paternity dispute.⁷ In India, the first case of parentage dispute solved by the use of DNA fingerprinting technology was in 1989.⁸ A transformation that investigation methodology at present looking at is not other than the incorporation of scientific technology to the fullest in the investigation. Once an investigation imbibe a scientific approach, reliability, authenticity will automatically increases. Science is a systematic study of a phenomena that will yield the uniform result once other factor remain constant. Development of DNA profiling was developed and initiated around 1980-90 where genetic data is being used for the identification purposes. Various methods have developed that are used for DNA evidence such as Restricted Fragment Length Polymorphism (RFLP), Polymerase Chain Reaction (PCR) a modified version of RFLP, Short Tandem Repeat (STR). DNA evidence does not give results that biases like testimonial evidence. Being a scientific evidence, DNA evidence provides evidence that does not support accused or victim but present the real story behind the commission of crime as to what happened, where happened and how it happened. It is useful to prove innocence as well as it will rule out the potential offenders if DNA does not match. Therefore it is free from any kind of biases. For the investigation, DNA

³ Hussain T, Sonowal B. *Evaluating the Efficacy and Constraints of DNA Evidence in the Criminal Justice System in India through Case Studies*. INTERNATIONAL ANNALS OF CRIMINOLOGY, 591-608 2025)

⁴ ARONSON, J.D. GENETIC WITNESS: SCIENCE, LAW, AND CONTROVERSY IN THE MAKING OF DNA PROFILING (2007)

⁵ JOHN BUCKLETON, JO - ANNE BRIGHT, DUNCAN TAYLOR, FORENSIC DNA EVIDENCE INTERPRETATION, CRC Press, 2nd Edition (2016)

⁶ Ibid

⁷ Singh, L. *DNA profiling and its applications*. CURRENT SCIENCE, 60, 580-585. (1991).

⁸ S. K. Verma, G. K. Goswami, *DNA evidence: current perspective and future challenges in India*, FORENSIC SCIENCE INTERNATIONAL (2014)

profiling is one of the important aspects where biological traces are present as it will lead to a modern and better results.

DNA forensic is one among them that has reached to a level where conclusiveness of a fact can easily be determined. Therefore DNA forensic is one of the strongest science among them that lead to a conclusive results and remove unnecessary doubts, provided investigation is done properly without any error. Degree of accuracy and reliability is much more when it comes to DNA evidence. Identification of the person, is one of the first thing for a law enforcement agency to link him/her with the crime. DNA evidence collected through the biological traces involved if any, will serve this purpose and assist in identification. DNA is one of the individualistic character that is unique among people, DNA forensic tap this identification marker in investigation. It reduces the reliability of testimonial evidence and if it is there, effectively works for the corroboration. Various scientific method such as Restricted Fragment Length Polymorphism (RFLP), Short Tandem Repeat (STR) etc. proves such individualistic character of the DNA. The technique of "DNA identification" compares the DNA of two bodily samples to ascertain whether or not they came from the same human being.⁹ All these factors requires a proper standard procedures and protocols in identification, collection, preservation, storing, transfer, analysing, handling etc. a strong chain of custody will bring the DNA evidence close to certainty. Usage of the scientific technologies with lesser human interference will eventually remove any kind of contamination, human error and any other issues that will reduce the reliability of DNA evidence. Once court identifies that DNA evidence is free from any kind of chain of custody issues, expert testimony supporting DNA evidence will have more credibility even though DNA evidence faces certain limitations. Therefore, DNA evidence is one among all the scientific evidence within forensic science discipline that brings all these facilities. Over a period of time it has become one of the standard method of investigation globally.

DNA profiling has been assuming a prominent role in the activities of the criminal justice system.¹⁰ DNA-based evidence has collected substantial trust in the Criminal Court system.¹¹ To make it more efficient, DNA banks have been established in most of the countries which is effectively and efficiently helping the criminal justice administration. United States of America, United Kingdom, Brazil,

⁹ Gans, J. and Urbas, G., *DNA evidence in the criminal justice system*, TRENDS AND ISSUES IN CRIME AND CRIMINAL JUSTICE (2002)

¹⁰ Machado, H., Granja, R. *DNA Technologies in Criminal Investigation and Courts*. In: *Forensic Genetics in the Governance of Crime*. PALGRAVE PIVOT, Singapore (2020)

¹¹ Ishfaq Ahmad, Faiz Faiz Bakhsh, *Emerging Developments in DNA Technology and Their Potential Implications for the Criminal Justice System of Pakistan*, CURRENT TRENDS IN LAW AND SOCIETY (2024)

Japan, Germany are some of the countries where DNA bank is significant in the criminal justice. CODIS and NDNAD in United States of America and United Kingdom respectively have been the front runner in establishing and managing the DNA data. DNA bank will not only provides assistance within the nation but it has a facilitating approach globally. Sharing of DNA data transnationally can also be effectively implemented along with due procedures and regulations. Modern criminal investigation requires a modern methodology, and to make it happen, DNA bank is one of the significant step that will easily cater this need.

III. ESTABLISHMENT OF DNA BANK IN INDIA

DNA bank is one of the requirement for the better DNA evidence based investigation for efficiency. DNA bank is a kind of infrastructure that works as a repository of the DNA databases as genetic profiles collected from individuals as samples. DNA bank as an establishment will hold and manage such genetic profiles for several purposes. DNA, through biological samples will be collected from the individuals and stored within the DNA bank as a repository. Once a crimes is committed and presence of biological samples or traces are found therein. Matching can be done of such samples with the repository DNA database for identification of the person involved not necessarily as a potential offender but to a direction to an investigation effectively without delay. The boom of DNA banking The last few years have witnessed an important expansion of DNA banking all over the world.¹² Presence of such biological samples be determine in such a way so that it will lead towards the explanation of the crime committed. These will surely assist the law enforcement agencies in collecting DNA and matching to find out the potential offenders as well. DNA bank will reduce the time taken during investigation and will be useful in identification of the potential offenders, explaining the crime committed, linking the suspects with crime sponce etc.

DNA bank will serve impact fully once the systematic procedures have been identified and implemented with a robust structural and functional regulations that will govern it. DNA bank contains DNA databases in the digital form can be establishment with an advanced scientific software technology.

¹² M. Sutrop Trames-, *Human Genetic Databases: Ethical, Legal And Social Issues*, JOURNAL OF THE HUMANITIES AND SOCIAL SCIENCES (2004)

IV. BIOETHICAL CONCERNS OF DNA BANK

DNA is one of the important and emerging tools for the criminal justice for so many reasons such as for the identification of the potential offenders, directing the investigation properly, solving of crimes, identifying the real culprit but exonerating the innocent convicts, identification of dead bodies or missing person, paternity dispute etc. Such actions also recognize that DNA evidence has exonerated offenders found guilty by our justice system on the basis of other evidence.¹³ DNA data bank will surely assist effectively without wasting time and resources. Establishing a DNA bank sounding so advanced but comes with certain issues and challenges. They have underlined bioethical issues as well. Such biological concerns dealing with the genetic information that is getting stored in the DNA bank. Bioethical issues involves potential of genetic information through DNA bank getting misused. A better and effective DNA bank will be establishing only after balancing certain bioethical principals such as privacy, justice, collection methods and usage protocols.

A. Privacy Issues

DNA as a biological component carries a genetic information of an individuals which will lead to family and ancestral genetic history. This information in the form of a genetic information is personal and private in nature. There is a chance of misuse and extraction of such information through these DNA bank if not secured properly. It should be established in such a way so that no unauthorised access of these information takes place. Measures to be taken to avoid chances of unethical hacking and data breaches for compromising the data. A storing and secure measures needs to be installed in the DNA bank to avoid any kind of contamination and misuse of data.

B. Collection Method and Consent Process

Creating a DNA bank requires a huge set of information of genetic information in the form of collection of DNA. DNA collection from each and every individual, whether Indian or foreigner is very much required to create a full set of data for various functions. Collection of DNA is collecting personal information from a person. Even though it is in the form of the physical in nature and act as a physical evidence, contain other information which can be used for extraction of genetic and private information. Consent of the person, that is informed consent is one of the requisite for the collecting DNA from each and every individual.

¹³ Singer, J.A., Miller, M.K. and Adya, M., *The impact of DNA and other technology on the criminal justice system: Improvements and complications*. ALB. LJ SCI. & TECH., 17, P.87 (2007)

Therefore a mechanism needs to be established where consent can be taken easily with complete information given to individual about the collection and usage of DNA. A real time access to their stored DNA data can be provided that will remove the doubt of how their DNA data being used in the DNA bank. Complete information of how the DNA data will stores, used, shared, access, examine and deleted will be given to the individual for getting their trust to provide DNA samples.

C. Supervision of DNA data in DNA bank

DNA being a biological information collected and stored in the DNA bank raises concerns over the supervision and vigilance over data. Being a bank of genetic information collected at large scale, automatically, at central and state level surveillance and supervision will be expected. Such huge data set surveillance will lead to state body control. Therefore, any activity done by the state body to the data stored shall be notified in real time, unless it explicitly required for secretive investigation for serious crimes, to the respective individuals from whom such data is collected. Each and every actions taken on such biological data must be made available to the individual as well with complete transparency,

D. Contamination and Misuse of DNA data

A scientific technological advanced measures needs to be created that will avoid any kind of misuse. Excess human interface will bring the doubts on transparency and genuineness of the data. Therefore, an advanced technological system will be created that will monitor the use of the data. It requires a technological infrastructure which will make anyone unable to intercept and get the unauthorised access through hacking to access the DNA data. In order to strengthen the DNA bank, less human interface is required and more of technological applications. It will secure the data breach and unlawful access of DNA data by human. More of a systematic and technological access to data will secure the data even though it results into any error. Without inclusion of human interface, such error will not be impacting the transparency and genuineness of data. Therefore a scientifically advanced system with a secure infrastructure need to be established that will secure the data from contamination and misuse.

E. Sharing of DNA data

DNA contains a genetic and biological information of an individual that leads to his healths, his family healths as well genetic family history. Therefore any kind of unlawful sharing must be avoided. A robust and systematic technology can be incorporated to secure the data from any kind of unlawful sharing. Genetic data reveals various health related,

ethnicity related information and if accessed breach the privacy of a person. Therefore sharing of data in the DNA bank needs a stricter regulation and protocols. Purposed for sharing such information needs to be strictly informed to individuals whose genetic information is being used and for what. This needs to be governed ethically to not affect privacy of a person. Such sharing will lead to stigmatising on the basis of such genetic information.

F. Removal and Retention of Data

DNA bank storing the data for indefinite period can be a huge blowback on the privacy of an individual. However it can be stored till the person lives and shall be used for the beneficial purposes only, if not accused of any offence. A proper guideline needs to be constructed that will clearly provide information as to how data is being retained in the DNA bank. Deletion of data can be done on certain circumstances only when individual is no more there. DNA bank storing the data shall be renewed and deleted on the basis of requirement of such data. Person who are not alive, their data can be deleted from the bank. If a data is being collected solely for the purpose of the crimes, then data can be removed after getting convicted or acquitted. For the protection of such biological information a bioethical standard needs to be established.

V. DNA AS AN EVIDENCE

DNA evidence is a scientific evidence. DNA forensic is one of the branches of a discipline of forensic science. Scientific evidence such as DNA is a tool used to ascertain the guilt or innocence of suspect with certainty when evidence such as blood, semen have been left at crime scene.¹⁴ Forensic science based on certain principles which makes science as one of the most applicable and authentic. Principles of forensic science are principle of individuality, principles of exchange, principle of progressive change, principle of circumstantial fact, principle of sampling, principle of analysis and principle of probability. Each and every principle makes forensic science more certain and authentic. Principle of individuality brings the individualistic character of the person which DNA forensic follows as DNA is one of the most individualistic trace in the form of biological evidence. No two persons can have the same DNA. Principle of exchange provides that when two matters come in the contact of each other, leaves or exchange their properties. DNA evidence follows principles of exchange largely as offenders leave their traces at the crime scene. Principle of progressive change brings the changes in the circumstance, and DNA forensic follows such changes at the crime scene, principle of circumstantial fact

¹⁴ Murangira B. Thierry, *Improving Rwandan Criminal Justice through Forensic DNA Evidence: An Appraisal*, BEIJING LAW REVIEW (2016)

establishes that facts does not lie but a man can lie. Similarly DNA forensic rely on the same as the presence of DNA or biological traces at the crime scene doesn't not make the offenders to take a defence of plea of alibi. Likewise DNA forensic follows the principal of sampling, principle of analyse and probability as well. DNA forensic can be ascertain, once bioethical ground is set up for the efficient implementations. DNA forensic must maintain the chain of custody property that will eventually brings the authenticity of it. DNA along with such principles must be implemented that also maintain the human dignity.

Indian constitution identifies the recognition of the DNA evidence within the fundamental duties to bring scientific temper in the form of scientific investigation. Major bioethical issues, which is also one of the concern within fundamental rights is collection of DNA and follow up examination will incriminate the witness. However, it should be noted that DNA is not a witness within Article 20(3) and does not lead to any self incrimination. Within Article 21, right to privacy is one for eh concern which generally considered that is violated in case of collection of DNA evidence. But collection of DNA can be regulated through legal framework and institutional framework. With a proper legal framework, such concern of privacy violation can be balanced with a regulation to maintain bioethical ground. Bharatiya Nagarik Suraksha Sanhita, 2023 clearly recognises the importance of the DNA evidence, therefore included the medical examination of the accused as well as victim in the case of sexual offences and other offences where chances of biological evidence presence is more. Forensic scientists have used genetic material (DNA) as evidence in criminal cases such as rape and murder since the middle of the last decade.¹⁵ Bharatiya Sakshya Adhiniyam, 2023 also recognises DNA evidence within the doctrine of res gestate as it speaks loudly about the same transaction with utmost proximity, it explains the cause of the act, also use for the purpose of identification of the potential offender, it also explains about the commission of the offences etc. DNA bank carries digital data and that can be regulated within Digital Personal Data Protection Act, 2023 along with its rules as well. DNA Profiling (Use and Application) Bill, 2019 is one of the bill which is pending, can be enacted with more secure provision to regulate the ethical and lawful use of DNA profiling.

VI. CONCLUSION

In the present scenario, where cases of sexual offences have been increasing day by day, including sexual abuse against minor children. And to provide justice to such cases, privacy and other bioethical issues

¹⁵ K. Roeder, *DNA Fingerprinting: A Review of the Controversy* STATISTICAL SCIENCE (1994).

need to be balanced with a formal legal framework that will overcome the pendency issue of such cases. DNA bank is one step towards the institutional framework for the better criminal justice administration. DNA evidence is one of the evidence which is authentic, reliable, efficient and has utmost probability. And DNA bank will surely bring efficiency in Indian criminal justice administration and enhance the investigation. DNA bank must be establishes with utmost measures that maintain the privacy concerns, informed consent, security measures. A robust legal framework for DNA bank is much needed that will balance the bioethical principles and criminal justice administration.