

Ethical Issues in Dna Profiling and Database Maintenance: A Forensic Justice Perspective

Mahadev Asaram Jadhav¹, Devkirani Pandharinath Pawar², Yogini Amit Ranade³

¹*Assistant Professor & Head, Department of Biotechnology & Bioinformatics, Deogiri College (Autonomous), Chhatrapati Sambhajanagar, Maharashtra*

^{2,3}*Department of Biotechnology & Bioinformatics, Deogiri College (Autonomous), Chhatrapati Sambhajanagar, Maharashtra.*

Abstract— DNA profiling has emerged as a critical tool in forensic science, widely used in criminal investigations to identify perpetrators, eliminate suspects, and exonerate the wrongfully accused. However, the growing reliance on genetic information raises a host of ethical concerns that challenge the boundaries between public safety and individual rights. This review paper critically examines these concerns from a forensic justice perspective, focusing on the ethical implications of DNA profiling and the long-term maintenance of forensic DNA databases. Key issues include the erosion of personal privacy, particularly due to the sensitive nature of genetic information contained within DNA profiles. The absence of informed consent in many forensic contexts further complicates ethical compliance, especially where DNA samples are repurposed for unrelated investigations. Indefinite data retention practices, including those involving individuals who have not been convicted, violate principles of autonomy and the presumption of innocence. Additionally, the use of familial DNA searching has proven effective in solving crimes but has simultaneously introduced the risk of genetic surveillance of innocent individuals. This review also addresses misidentification risks arising from human or technical errors in forensic processes. Moreover, the overrepresentation of marginalized racial and socioeconomic groups in national DNA databases reflects and perpetuates existing systemic inequalities within the criminal justice system. This review paper advocates for robust legal and ethical frameworks to regulate DNA profiling practices. Recommendations include transparent consent protocols, proportional data retention policies, independent oversight bodies, and measures to mitigate bias. This study concludes that while DNA technology provides significant benefits in forensic science, ethical safeguards must be prioritized to ensure that its application aligns with human rights, privacy and justice.

Index Terms— DNA profiling, forensic ethics, informed privacy, racial bias, forensic justice, genetic surveillance, database retention

I. INTRODUCTION

The advent of DNA profiling has been one of the most transformative developments in forensic science and criminal justice over the past four decades. Since its first use in a UK criminal case in 1986, DNA profiling has revolutionized the way investigators approach crime scene analysis, identification of suspects, and the adjudication of legal disputes involving biological evidence. It has enabled courts and law enforcement agencies to solve cases that might otherwise remain unresolved, providing both investigative power and judicial clarity in complex criminal matters (Jobling & Gill, 2004). Beyond its application in criminal investigations, DNA profiling is also used in paternity testing, immigration disputes, and the identification of disaster victims. However, as the technology behind DNA analysis has evolved in scope, speed, and sensitivity, so too have the ethical questions surrounding its use. What began as a tool for confirming guilt or innocence in isolated cases has now expanded into a system of national and increasingly international DNA databases. These repositories contain the genetic information of millions of individuals, including not only convicted criminals but also arrestees, suspects who were never charged, and in some cases, volunteers. The construction and maintenance of such databases, while serving a utilitarian function for public safety, have given rise to serious concerns about privacy, consent, data ownership, and potential misuse of information

(Williams & Johnson, 2008). From a forensic justice perspective, the central question is not whether DNA technology should be used, but rather how it should be used in ways that respect the legal and moral rights of individuals. Justice in a forensic context demands more than just catching the guilty it also requires protecting the innocent, ensuring fair procedures, and maintaining public trust in the institutions tasked with upholding the law. This balance becomes especially precarious in light of several high-profile cases involving wrongful convictions based on flawed or misinterpreted DNA evidence, as well as ethical breaches concerning how samples were collected, stored, or reused (Thompson, 2006; Greely, 2011). Furthermore, the expansion of DNA databases has brought to the forefront issues of racial and social inequality. Studies have shown that marginalized and over-policed communities particularly people of color and those from lower socioeconomic backgrounds are disproportionately represented in criminal DNA databases (Murphy, 2007). This overrepresentation not only raises questions about systemic bias but also increases the likelihood that members of these communities will be subject to surveillance, investigation, or suspicion based solely on their genetic proximity to others who may be under scrutiny.

In addition, the use of familial DNA searching where the DNA of close relatives is used to identify potential suspects poses a novel ethical dilemma. While this technique has yielded investigative breakthroughs in several high-profile cases, such as the Golden State Killer, it also blurs the line between targeted criminal investigation and generalized genetic surveillance (Curtis, 2020). Individuals who have not committed any crime may become indirect targets of police interest simply due to their genetic relationship to someone in a DNA database. This raises critical questions about consent, genetic privacy, and the scope of forensic authority.

Another ethical frontier involves the commercialization and commodification of genetic data. As private companies such as 23andMe and Ancestry.com collect massive genetic datasets, concerns have emerged about the accessibility of this data to law enforcement agencies, researchers, and even advertisers. The blending of public forensic databases with private commercial data sources introduces a complex web of regulatory and ethical

concerns, particularly when individuals are unaware that their data may be accessed by third parties for purposes beyond genealogy or health reports (Ram et al., 2018).

This review aims to explore and critically evaluate these pressing ethical issues associated with DNA profiling and the maintenance of forensic DNA databases. It will analyze how the current practices align or fail to align with the foundational principles of forensic justice: fairness, transparency, proportionality, and respect for individual rights. Drawing on real-world cases, legal precedents, scientific literature, and ethical frameworks, the review will provide a detailed examination of topics such as privacy, informed consent, racial bias, data retention, misidentification, and the ethical governance of genomic data.

Ultimately, this review argues that while DNA profiling is a powerful tool for promoting public safety, it must be implemented in a way that does not compromise the moral and legal rights of individuals. The credibility and ethical integrity of forensic science and by extension, the justice system depend on striking the right balance between investigative utility and human dignity. Ethical foresight, legal safeguards, and transparent policy-making are not optional they are essential for ensuring that the use of DNA in criminal justice serves justice in the truest sense of the word.

A. Data privacy & data sharing

Privacy is one of the most pressing ethical issues in DNA profiling. A DNA sample contains more than just identification data it carries information about familial relations, ancestry, and predisposition to certain diseases (Kaufman, 2018). When law enforcement agencies store such sensitive data, there's a risk of misuse or unauthorized access. A recent case highlights the gravity of this concern: a rape survivor's DNA, originally submitted for investigative purposes, was later used to implicate her in an unrelated property crime (Matsakis, 2022). Such actions erode public trust and discourage victims from participating in investigations (Wahlberg et al., 2022). Informed consent is foundational to ethical data collection. Individuals should fully understand how their DNA will be used, whether it will be stored, and if it will be shared with third parties or researchers (Grady, 2015). However, in the forensic context, consent is often either presumed or waived. Furthermore, the sharing

of data between law enforcement, researchers, and commercial entities like genealogy services (e.g., 23andMe) has amplified concerns. Without explicit consent, using relatives' DNA to track suspects may violate family members' rights (Rothstein & Talbott, 2006).

B. Data storage and retention

The issue of indefinite data storage raises significant questions about due process and the presumption of innocence. In many countries, DNA profiles from people arrested but never charged are stored indefinitely (Wallace, 2011). This can lead to systemic injustices and racial profiling. In *S. and Marper v. United Kingdom* (2008), the European Court of Human Rights ruled that retaining DNA data of unconvicted individuals violated Article 8 of the European Convention on Human Rights, which protects privacy (European Court of Human Rights, 2008).

C. Familial DNA Searching

Familial DNA searching is an investigative technique that uses genetic information from DNA databases to identify close biological relatives of individuals whose DNA was found at a crime scene. Rather than searching for an exact match, investigators look for partial matches that may suggest a close family connection such as a parent, sibling, or child to a known profile in the database. This approach has led to major investigative breakthroughs, but it also raises significant ethical, legal, and social concerns that challenge traditional boundaries of forensic practice. The most high-profile example of familial DNA searching is the Golden State Killer case, where law enforcement used a public genealogy website, GEDmatch, to identify relatives of the suspect through crime scene DNA. This ultimately led to the arrest and conviction of Joseph James DeAngelo in 2018 for a series of rapes and murders committed in the 1970s and 1980s (Ram et al., 2018). The case demonstrated how combining forensic science with public genetic databases could solve cold cases that had remained dormant for decades. Following this success, familial searching gained momentum as a powerful law enforcement tool. Many U.S. states, including California and Colorado, adopted formal protocols for familial DNA searches within state databases.

Law enforcement agencies praised the method for its potential to generate leads in otherwise stalled investigations and bring long-awaited justice to victims and their families. Despite its utility, familial DNA searching has triggered intense ethical debate. At the heart of the controversy is the fact that individuals who are not suspected of any crime may become subject to police scrutiny simply because they are genetically related to someone whose DNA is in a law enforcement database. This creates a form of genetic surveillance, where entire families and communities may be indirectly monitored without their knowledge or consent (Curtis, 2020). Critics argue that this practice infringes on individuals' privacy and autonomy. Unlike traditional forensic investigations, where suspects are chosen based on behavioral or circumstantial evidence, familial DNA searching places people under investigation purely because of their genetic proximity to another person in a database. This undermines the foundational principle of presumption of innocence and exposes people often from overrepresented communities to intrusive and unwarranted scrutiny (Murphy, 2007).

Moreover, the technique raises profound questions about informed consent. Individuals who voluntarily provide their DNA to genealogy services or health databases may not realize that their data could indirectly implicate family members in criminal investigations. In the Golden State Killer case, for example, investigators used data from GEDmatch, a publicly accessible genetic database not originally intended for forensic use. Although GEDmatch updated its terms of service to require users to opt-in for law enforcement access, the line between public and private data remains blurry and contentious (Ram et al., 2018). Another alarming ethical breach came to public attention in 2022, when it was reported that a rape survivor's DNA, collected as part of a sexual assault investigation, was later used by San Francisco police to link her to an unrelated property crime. This case did not involve familial searching in the traditional sense, but it underscored the broader concern that DNA data collected for one purpose can be repurposed without consent (Matsakis, 2022). It illustrated how easily a survivor's trust can be violated when genetic data is misused for investigative convenience, thereby potentially re-traumatizing victims and discouraging future cooperation with law

enforcement. This kind of data repurposing also creates a chilling effect on public cooperation.

Victims and witnesses may be reluctant to participate in criminal investigations if they fear their genetic material could be stored indefinitely or used against them or their relatives in the future. Familial DNA searches also compound existing racial and socioeconomic disparities in criminal justice. Since minority populations are overrepresented in criminal databases due to systemic policing biases, the use of familial DNA searching disproportionately affects Black, Latino, and Indigenous communities (Krimsky & Simoncelli, 2011). This means that individuals from these groups are far more likely to be indirectly included in forensic searches, further perpetuating cycles of surveillance and marginalization. Legal scholars and human rights organizations have called for greater transparency, oversight, and limitations on the use of familial DNA searches. In many jurisdictions, there are no clear legal frameworks governing the practice, allowing law enforcement to adopt broad or inconsistent policies. The lack of standardized ethical guidelines exacerbates concerns about privacy violations and unequal treatment under the law (Curtis, 2020). The debate over familial DNA searching is not about rejecting forensic innovation it is about ensuring that innovation does not outpace ethical safeguards. Key questions remain unresolved:

- Should individuals be notified if they become subjects of investigation through familial searching?
- What level of genetic relatedness (e.g., first-degree vs. distant relatives) justifies initiating an investigation?
- Who should regulate access to public and private genetic databases?
- How do we ensure equity in the application of this technique?

Answering these questions will be essential for developing a legal and ethical infrastructure that respects both public safety and individual rights. There is a growing consensus among bioethicists and legal scholars that familial DNA searching must be accompanied by transparent policies, judicial oversight, and informed consent mechanisms (Grady, 2015; Greely, 2011).

D. Risk of misidentification

Despite its scientific accuracy, DNA profiling is not full proof. Laboratory errors, sample contamination, and human mistakes can result in wrongful convictions (Thompson, 2006). Andrew Malkinson's wrongful imprisonment for 17 years in the UK is a stark reminder of how forensic technologies can fail (Bowcott, 2024). Only after retesting DNA evidence was his innocence proven. Such cases underline the necessity for stringent quality controls and review systems in forensic laboratories (Mnookin et al., 2011).

E. Racial, socioeconomic bias and ethical use of genetic information

Ethical concerns also arise from the racial and socioeconomic bias inherent in DNA databases. Minority groups are overrepresented in criminal justice systems, which translates to disproportionate inclusion in DNA databases (Murphy, 2007). This creates a feedback loop, increasing the likelihood of being investigated or falsely implicated. According to Krimsky and Simoncelli (2011), the over-collection of samples from specific populations can exacerbate systemic racism and social inequality within the justice system. Another ethical issue concerns the use of genetic information beyond identification purposes. Genetic data can infer health predispositions or ancestral origins, which, if accessed by employers, insurers, or government bodies, could lead to discrimination (Rothstein, 2008). The case of 23andMe facing scrutiny for potentially selling user data and subsequently facing bankruptcy underscores the dangers of exploit genetic data without stringent regulation (Krantz, 2025).

F. Balancing public safety, individual rights & recommendations to ensure ethical integrity of DNA profiling

Balancing public safety with individual rights remains a core dilemma in forensic ethics. While DNA profiling contributes to public safety, it should not override civil liberties. Any intrusion into personal privacy must be proportional, lawful, and necessary (Bieber, 2006). Comprehensive frameworks and oversight mechanisms are essential to ensure that DNA technologies serve justice, not surveillance or control (Kaye, 2010). To ensure ethical integrity in

forensic DNA profiling, the following measures are recommended:

- Transparent consent protocols for sample collection and data usage.
- Time-bound retention policies, particularly for innocent individuals.
- Independent oversight bodies to audit forensic laboratories.
- Bias audits of DNA databases to reduce overrepresentation of certain groups.
- Strict regulation of data sharing between forensic, commercial, and research entities.

II. CONCLUSION

While DNA profiling offers remarkable benefits in forensic science, it also brings a host of ethical issues that cannot be ignored. From privacy violations to potential discrimination and wrongful convictions, the misuse of genetic data can undermine justice rather than serve it. Ethical DNA database management requires a careful balance of privacy, consent, public interest, and fairness. With the right policies and oversight, it is possible to use DNA profiling responsibly, aligning technological capabilities with justice and human dignity.

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