GLSR Global Legal Studies Review

DOI: 10.31703/glsr.2021(VI-IV).02 p- ISSN: 2708-2458 e- ISSN: 2708-2466 L- ISSN: 2708-2458

Pages: 10 – 17 Vol. VI, No. IV (Fall 2021) URL: http://dx.doi.org/10.31703/glsr.2021(VI-IV).02

The Indispensability of Forensic Accuracy in Criminal Justice System

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Abstract: *DNA analysis has transformed forensic science, assisting in the capture of serial killers and the exoneration of innocent people falsely accused of major crimes. As DNA profiling becomes more sensitive and is utilized in more cases, it is critical that public and professional expectations are based on reality rather than television crime drama. In the pursuit of justice, DNA evidence is a useful and neutral instrument. DNA evidence will play an increasingly essential part in investigating crimes in the future, whether it helps convict or absolve persons. As a result, victims will receive better justice, and communities will be safer. This article discusses the vitality of DNA in the criminal justice system and provides an analysis pertaining to international practices.*

Key Words: DNA, Crime, Justice, Evidentiary Value, Courts

Introduction

Through the application of technology and rapid advances in human genome research, modern biology pursues new and improved ways to progress the quality of life of people living in this world. The structure of deoxyribonucleic acid (DNA) 's discovery in the 1950s, as well as the realization of its genetic nature, made it necessary for man to put this information to unforeseen uses. Genetic engineering, DNA fingerprinting, whole-genome sequencing (by men, animals, plants, or microorganisms), and exploiting the variations between male and female DNA (i.e., X and Y sperm) have all been historical rules. However, countless of today's expected technologies on various societies are likely to differ due to varying social conditions, historical contexts, and cultural traditions.

In white corpuscles, DNA can be found. It is the chromosomes' structural material. It's where the genetic code is kept. As a result, it influences human personality, conduct, and physical traits. As a result, DNA is referred to as the genetic building block of life.

Every person has a distinct DNA pattern that distinguishes them from others. Monozygotic twins, on the other hand, have identical DNA structures because they are born from the division of a single fertilized egg. Monozygotic twins have the same genetic makeup. As a result, DNA is the genetic material found in our body's cells. Except for sperm cells from men and eggs from women, which have just 23 chromosomes each, every nucleated cell has 46 chromosomes.

Significance of DNA Profiling in Criminal Investigation

Forensic experts and criminal investigators have longed to accurately identify the source of blood and other bodily solutions, and the quest is not fully relinquished as yet. DNA profiling techniques are currently being developed, and they promise to be more accurate than current methods of fingerprinting of defendants, as it allows the researchers to examine human biology material through the DNA molecule, commonly found in every alive cell in the body, and which contains the genetic material that determines who you are. The DNA is extracted from sources such as sperm, blood, or tissue and chemically divides it into fragments during the DNA profiling. Due to certainly occurring variances in the DNA molecule from one person to the next, a substantive evidence in a criminal case can be acquired. Moreover, it is not irrelevant to state that the DNA profiling evidence should be considered an liable form of scientific evidence, just like other evidence,

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Citation: Qaiser, K., Qaiser, Z., & Chughtai, Z. A. (2021). The indispensability of Forensic Accuracy in Criminal Justice System. *Global Legal Studies Review*, *VI*(IV), 10– 17. https://doi.org/10.31703/glsr.2021(VI-IV).02

produced before the courts, as long as stringently designed laboratory processes are scrupulously followed. DNA profiling has a special application in criminal law, because of the prospect of establishing culpability of alleged accused, whose blood or semen deposits are found at the scene of a crime, it is also considered a valuable technique in the investigation of homicide and sexual offenses. In practice, when an attacker is harmed or drops any type of body sample (hair roots, saliva, blood, remains, etc.) at the crime scene, the DNA profiles have the capacity to recognize the person from his or her own biological material deposit. Additionally, it has been seen and reported, all across the world, that Paternity testing and criminal investigations have both benefited from DNA profiling, and it continues to facilitate the criminal justice system in several parts of the world.

Balancing the use of technology to benefit Society Compared to an Individual Commission of Alleged Offence. (Historical perspective of DNA fingerprinting).

Although DNA was discovered by Swiss scientist Friedrich Miescher in the 1860s, it was not until 1953 that DNA was a three-dimensional double helix, determined by James Watson and Francis Crick. This determination paved the way for the speeding up of DNA research and applications all over the globe. Laboratories began utilizing DNA to confirm paternity in disputed cases in the 1980s. In 1986, investigators asked Alec Jeffreys, a young geneticist, inventor of the genetic fingerprint in 1984, to assist them in solving a murder case. Reason being that it was one of the most profoundly influential pieces of research ever carried out in a British laboratory, producing the world's first DNA fingerprint, a technology that has revolutionized crime scene investigations, led to the convictions of murderers and rapists, and transformed immigration disputes and paternity cases. It so happened that, during the time of the discovery, two 15-year-old girls were murdered after being sexually molested. After an initial investigation, a teen boy with learning disabilities was charged with the offence; however, in truth, he admitted to only one murder, not both, and the murder became a mystery. Resultantly, the Police engaged Jeffreys and his team to show that the teen was the perpetrator of both murders as their investigation could not be useful in this regard. To their surprise, it was found out that, in actuality, the youngster had not committed any offence nor a misdemeanor, and was falsely implicated now without any proper leads; the Police and Jeffrey's team began compiling DNA profiles of local men in the vicinity. Police apprehended a local baker named Colin Pitchfork after it was believed that he boasted about submitting a friend's DNA. Later Pitchfork's DNA was successfully matched with that found at the crime site by Jeffreys and his team; hence he was charged with both murders. The work of Jeffrey, sparked widespread interest even today; employment of DNA evidence is used all over the world to educate people and judicial officers, and their importance is undeniable. It is a surprising aspect that the majority of the population of the world are not familiar with the significance of DNA, also about the admissibility of evidence procured by sampling, profiling, etc. Legal battles have been fought for several decades without proper investigation or lack of utilization of DNA. It is suggested that Databases and laboratories must both follow the set of rules, which major international investigation agencies use while keeping the privacy of victims and alleged offenders intact.

DNA profiling may be merely another technological instrument for forensic identification, but as Kimmelman (2000) points out, DNA is qualitatively different, possessing features that "make it fundamentally different from its predecessors in terms of the ethical and societal considerations it presents. Maintaining the DNA databases of criminals is a routine practice in many criminal justice systems; however, it presents several ethical issues that need to be addressed to date. There is a dearth of proper mechanisms related to standardized testing procedures. On a positive note, it is undeniable that DNA evidence assisted in the release of several wrongfully imprisoned people, and it made aspects such as the reliability of DNA profiling or sampling questionable.

Technological Revolution and Social Changes

Friedman in his book, emphasized the argument between those who consider law as not to be a driving force rather it must learn to follow, also that social sentiments are pivotal in structuring the policies and developing the mechanisms. According to Friedman, the law must be a resolute agent in the formation of new standards. It goes without saying that modern scientific and technological progress, as well as the radical transformation of society that resulted, provided the best evidence to support the advocates of the aforementioned first theory. Science has, without a doubt, existed since ancient times, according to Justice Markandey Katju. Era. Historically, however, the study of nature's laws and technology, i-e, the application of these laws to create socially valued items, were almost totally

different quests. Currently, there is an evident growth in the disciplines of science and technology, mainly because of their connection with each other. A concept such as genetic evidence is recently introduced, which demonstrates the link between genetic science and criminal legal system.

The Impact of Genetic Science on the Legal System

Although the initiation of DNA evidence in criminal court was initially met with much controversy, it has since become a much-welcomed tool in the administration of justice. Advances in DNA testing procedure, as well as growing knowledge of DNA evidential concerns among legal practitioners, have had a significant impact on its evolution. The role of forensic science and DNA technology in the legal system is critical.

As a scientific profession operating within the confines of the legal system, forensic science not only gives assistance in criminal and civil investigations but also provides the courts with precise information about all aspects of criminal identification. In fact, recent advances in modern biological research have revolutionized forensic science with far-reaching implications for the administration of justice. The arrival of DNA testing in the new scientific age elevates forensic science from a bystander to a critical player in the judicial system.

As a result, with the exception of "genetically identical twins," the chemical structure of DNA in each individual's cells is the sole determining factor in distinguishing one from another. By analyzing numerous substances found on the crime scene, such as anybody's fluid, hair root, saliva, fibers, and other items that are involved with the crime and properly linked to the perpetrator of the crime, modern genetic research can be utilized to identify perpetrators in criminal cases. In fact, this technology is being used as a new type of circumstantial evidence, which is valued higher than direct and optical evidence because of its objectivity, scientific precision, and infallibility. In the case of a disputed paternity of a kid, for example, a simple comparison of DNA collected from the child's bodily fluids or tissues with those of his father and mother can provide infallible evidence of biological parenthood in a short period of time. There is no need for additional corroboration because quick medical evaluation and proper sample of body fluids, followed by quality forensic investigation, can provide incontrovertible evidence, avoiding the need for lengthy legal arguments.

The Evolution of DNA Evidence and Its Legal Implications

Forensic science is a branch of science that operates within the confines of the legal system. Its goal is to provide direction to individuals conducting criminal investigations and to present reliable information to courts in order for them to resolve criminal and civil issues. It is regulated to this extent by law, both statutory and precedents.

The use of social science theories to produce policies to improve society is commonly referred to as law, and it seeks to feat the benefits of modern technical breakthroughs to increase the effectiveness of in the form of patterns of pressure, through which society maintains social order and consistency. In criminal cases, DNA evidence is admissible provided it is relevant to the facts at hand, presented properly by skilled witnesses, and does not lead to the suspect's unreasonable preconception. Scientific opinion (expert evidence) in the interpretation of DNA evidence may be accepted if it is presented by people who have specialized expertise based on education, research, and experience. DNA identification is a technique that examines the DNA of two body samples to see if they come from the same person. The presence of identical DNA in both samples indicates that they are from the same individual (or identical).

The use of DNA in Criminal Justice Administration

Forensic science is a scientific discipline that operates inside the legal system to provide assistance to individuals conducting criminal investigations and to provide correct information to courts regarding all aspects of criminal identification so that judges can respond in resolving criminal cases.

Human bodies or crime scenes, as well as small samples of human biological material, are used to create DNA profiles. Examining samples taken from people's bodies can reveal their DNA profiles. To get such samples, forensic procedures such as flood sampling by injunction, plucking hair at the root, and taking buccal swabs from inside the mouth can all be used (whether voluntarily or involuntarily). Skin cells from clothing, saliva from a cigarette butt, a square-centimeter bloodstain, or three micrograms of semen from a vaginal swab can all be used in modern DNA profiling technology.

Sampling, DNA filing and every other genetic evidence procurement tool is becoming increasingly crucial in the criminal justice system because of the aspects of accuracy and impartiality. Perpetrators can be identified, when

the biological evidence at disposal. DNA can be used to accurately identify perpetrators, as well as clear suspected and exonerate persons who have been unfairly convicted of crimes. If we discuss the above stated with reference to Pakistan, then we can see that at the federal and state levels, the forensic investigation has become necessary; however the current DNA collection and analysis system is outdated. It is not merely a want of latest equipment's alone but a whole culture of dispensation of justice, especially criminal justice.

Resentment is often seen with regard to sampling and admissibility of genetic or forensic evidence in courts, majorly because societal norms do not allow many victims to get checked through the process of DNA. Cases such as rape, parenting and legitimacy of children often comes up with a lot of humiliation and disrespect, therefore it becomes difficult for the courts to adjudicate the matter in totality. Moreover, in numerous situations, public crime/forensic labs have been stifled by excesses of unanalyzed DNA samples, and this aggravated the aspects of accuracy and timely reports. Furthermore, granting labs the benefit of the doubt, they may be understaffed to manage the growing volume of DNA samples and evidence, compounded by backlogs and a lack of modern technology, to name a few causes of delays in criminal justice administration. Additional research is needed to develop faster methods for analyzing DNA evidence, and criminal justice specialists need more training and support to guarantee that DNA evidence is used effectively to solve crimes and to assist victims and their families when sufficient evidence cannot be obtained. DNA testing is double edged weapon to address issues pertaining to victim's misery and also to create suitable circumstances for wrongfully convicted people.

Additionally, the want of proper enforcement of laws in Pakistan's judicial system can never be ignored. Our judicial system has been jeopardized by several cultural, political and lack of law's implementation issues in the last 7 decades, and the present condition is not very encouraging to date. To sum up or to brooch the debate it is relevant to state that the law of evidence in Pakistan i-e Qanoon -e Shahadat order 1984 (QSO) needs a revamp to a large extend.

DNA in Pakistan's law of evidence. Admissibility of DNA evidence in Courts of law in distinct issues

Courts in Pakistan find it an uphill task to generate a system which can facilitate the DNA evidence in the existing legal principles. Pakistan lacks any specific legislative framework which authenticates the DNA evidence, and resultantly courts are bound to follow the existing standards of evidence as enshrined under Qanun-e-Shahadat Order 1984 ('QSO') . QSO uses Articles 59 [10] and 164 [11] to assess DNA evidence by specifying that reasons for the acceptability of various sorts of proof made available by scientific and technical achievements, whilst another provision establishes grounds for the acceptability of expert opinion in areas such as science and art. We may not get the most out of DNA if we simply look at it from this perspective.

If we consider the main dissimilarity between DNA evidence and medical opinion is that the latter does not precisely identify criminals, whilst the former does. As a result, it would be more appropriate to evaluate it from a legal perspective. However, as we'll see, the courts haven't consistently applied the law, and there's still a lot of ground to cover.

In Pakistani courts, DNA evidence is used in two different manners firstly, in Cases of Paternity and Legitimacy and secondly, pertaining to sexual offences. We are familiar that paternity is a sensitive and essential issue since it has numerous legal and societal ramifications. In a community with religious inclinations, the problem of paternity is likely to take on more weight. As a result, nearly all legal systems go into great detail about how to determine paternity. In Pakistan, paternity determination is a matter of personal law. Pakistan, being a Muslim-majority country, the basic issues which are addressed by DNA are paternity related. Many issues are reported in the courts which can only be resolved through DNA testing. The parliament of Pakistan enacted Article 128 of the QSO in conformity with the Hanafi doctrine and stresses upon the birth of a child. A child born after six lunar months of marriage and within two years of divorce is regarded genuine and credited to his or her putative father, according to this provision. This fact is considered "conclusive proof." under the aforementioned rule, and no evidence can be submitted to challenge it. There are two exceptions to this: (a) *if the father disowns the child*, and (b) *if the child is born after the mother's iddat period has expired after six lunar months.*

The Supreme Court of Pakistan has mostly followed the article 128 of the QSO, and in removing DNA evidence from paternity procedures, they have given primacy to the society's collective interest over an individual's

interest. However, there are certain exceptions also created which highlighted the importance of DNA evidence. The court also stated that Article 128 is based on a long-standing theological perspective, which supported its decision. As a result, DNA evidence in paternity trials will remain inadmissible unless that religious perspective is altered. In terms of the argument that community interests are more important than individual interests, as we will see given the second half of this section, it could lead to a different result in diverse settings.

However, DNA evidence is admissible to the extent of sexual offences. In a leading case law it is dealt on secondary footings and a corroborated piece of evidence. 2013 SCMR 2003, the Honourable Supreme Court held that; and I quote;

"It is should be noted that to determine their liability or truth of allegation of any fact administration of DNA test is not new. In the beginning, DNA was not considered so trustworthy, as a result, Courts frequently excluded or omit it from the evidence and conviction was not awarded on its base ". Currently, Pakistani courts are also considering the DNA profiling results on the time of convicting accused; however, DNA testing could not be considered as definite prove and no corroboration is required from oral evidences". Additionally, the judicial approach is the polar opposite of what we have seen in paternity cases. The question that immediately arises is: why is there such a disparity? The contrast in legal structures regulating the two streams of cases, as embodied in the Qanoon e shadat order, provides the answer to this question. Because of advances in science and technology, DNA evidence has grown more prominent. Article 164 of the QSO declares acceptable any piece of evidence made possible by breakthroughs in science and technology. An expert witness is a technician who performs a DNA examination, and his testimony is allowed under Article 59 of the QSO. Furthermore, unlike Article 128 of the QSO, there is no specific provision excluding the admissibility of evidence by enunciating a convincing conjecture, as we saw in paternity disputes as discussed earlier.

In Pakistan, DNA evidence is almost never used in any other types of criminalities. The current legal framework, as well as a dearth of technical expertise and capability in crime scene investigation, have influenced this judicial approach. We can acquire DNA evidence from crime scenes if they are carefully inspected, however, due to the absence of manpower and scientific infrastructure, such crucial evidence is frequently lost. In Pakistan's current legal structure, DNA evidence is equivalent with professional evidence, severely lowering its value.

The Conflict between Upholding of Human Dignity and Considering DNA Testing as a Derogatory Perspective of Criminal Justice System

Criminal justice is one of the most important areas of human rights, where the legal system is put to the test on a regular basis in order to maintain social peace and security on the one hand, and to protect the human dignity of both victims and perpetrators of crime on the other. The advocates of human rights all across the world are quite vocal about the misuse of DNA or genetic testing and attached with several ethical and moral issues which are not addressed as of now. Respect for privacy, liberty, personal best interests, responsibility for future children's genetic health, maximizing societal best interests/minimizing major social harm, and genetic justice are only a few of the ethical problems that surround DNA testing.

The use of DNA profiling by law enforcement authorities has increased all around the world since its invention in 1985. Forensic DNA databases are being implemented with little public debate and insufficient safeguards for human rights. As a result, the balance between legitimate law enforcement demands and individual rights is being lost, even as DNA interrogation methods get more sophisticated. Furthermore, forensic DNA collection is progressively being sold to nations with shaky legal systems. DNA testing was first employed in the criminal justice system of the United States, one of the first countries to do so, to provide additional evidence that might be used to convict violent felony criminals or release the innocent on a case-by-case basis. The original DNA database legislation in New York State, according to a 1992 report, would be limited to because murderers and sexual offenders are more likely to be apprehended because DNA evidence is more likely to be discovered in killings and sexual assaults than in other crimes. Recidivism is common among sexual criminals.

Currently, 56 countries throughout the world operate forensic DNA databases, with at least 26 more planning to do so in the near future, including Tanzania, Thailand, Chile, and Lebanon. A number of countries are aggressively expanding their databases, including Australia, China, Israel, and New Zealand. Bermuda, the United Arab Emirates, Uzbekistan, and Pakistan are among the countries that have proposed enrolling their whole populations in the database. DNA

databases around the world differ greatly on topics such as access and consent, as well as the keeping of both DNA samples and the computerized profiles derived from them. However, they all have one thing in common: a lack of adequate privacy and human rights safeguards.

In the criminal justice system, it is important to gather certain types of body material in order to use DNA profiling. It's possible that the sample was obtained by chance. When a sample is taken without coercion (for example, by extracting an air follicle from the defendant's clothes), it is legal in India and many other countries. The primary legal concern is whether unintentionally obtained biological samples can be used for DNA testing. This question has no possible answers.

There are two different ways to think about this. The first is that the DNA test does not infringe on the right to bodily integrity in and of itself; therefore, if the body material was obtained lawfully, the right to conduct a DNA test on it also exists. This argument is based on the assumption that DNA testing is not governed by any laws. The second argument is based on the idea that everyone has the right to decide what happens to their own physical tissue. This kind of reasoning works particularly well in health-care legislation. It is based on the conviction that more has to be done.

Increased police powers and a fast acceptance of a conservative crime-fighting agenda in the criminal justice system administration have produced a number of questions concerning the usage of DNA (and other scientific evidence). These fears are understandable, considering the growing attack on the right to silence as a defence mechanism for "the guilty." To address the lack of critical debate regarding the role of scientific technology in the loss of civil liberties, a rethink of the concept of "justice," which corresponds to the concept of a value-free scientific process, is required. Everyone has the right to a fair trial and a public hearing before a neutral and independent tribunal, according to international human rights law, however the same rule applies to criminal justice system which needs to address substantial issues dealing with forensic evidence and DNA testing.

It is predicated on the belief that there is a larger demand for body tissue protection as a result of the progression of science According to this viewpoint, DNA testing as a whole is ineffective. an infringement on the right to bodily integrity as a result of previous interference, as a result of the removal of body parts from the body. suspect's intention. The Supreme Court of the Netherlands has ruled that the taking of the use of body tissue from the suspect for DNA testing is not permitted.

Now, as per the European Convention on Human Rights (ECHR), the use of force to obtain DNA samples must be weighed against the ECHR's paragraphs 3 and 8. Article 3 deals with serious interferences with a person's physical or psychological integrity. In actuality, breaking article 3 is rare, not only because the authorities would stop before that point, but also because the vast majority of individuals would surrender. It is more likely that article 8 will be violated. Clearly, collecting a blood sample without consent is an intrusion into one's private life.

It would be permitted only if it was "lawful" and "necessary in an independent society for the prevention of crime and the protection of other rights." According to Kruslin, the power must be clearly defined in law, its ramifications must be obvious to the public, and it must be compatible with the rule of law in order to be "in harmony with the law." The fourth condition, as Kruslin and Malone point out, is the most crucial control because domestic legislation must have some practical and effective control that guards against arbitrary interferences or misuse of discretionary authorities in order to be compatible with the rule of law.

Forced testing is the most important question in the forensic application of DNA technology. In the United Kingdom, there is a distinction established between intimate and other body samples. Under the right circumstances, a non-intimate sample can be obtained without consent. 84 An accused person cannot be forced to submit a personal bodily sample, such as a sample of bodily fluid. In England and Wales, if a suspect refuses to cooperate with a request for an intimate body sample in correct form without good reason, the court might make any inferences it sees fit.

Future of DNA Evidence in Criminal Justice System

Lawyers are leery about DNA profiling for a variety of reasons, some good and some poor. DNA profiling is the most powerful breach yet with the English common law history of self-incrimination protection. Lawyers reject "machine" evidence, in which the outcome is effectively determined by a scientific instrument; they believe DNA profiling is not a perfect and flawless investigative and probative tool. It produces incisive findings in the hands of a qualified operator. It produces garbage in the hands of a fool. Its main advantage is that the garbage is evident; it will not cause a false-positive

result from a sample (a false positive is a conviction that is not supported by evidence). However, the method is only as trustworthy as the sample it receives, therefore if a negligent or fraudulent sample collection from the crime scene or suspect occurs, the result will be incorrect, regardless of the science's precision. The odds ratio will have reduced probative value if the sample is damaged. The procedure entails a huge number of minor phases, each of which must be completed correctly. Material transfers from one step to the next are the most typical source of mistake. Quality assurance, test interpretation, independent scrutiny, and the right of the defense to see the evidence are also difficulties. At the very least, all of these issues should result in widely accepted testing and quality control techniques and standards.

In the criminal judicial system, DNA technology is becoming increasingly important, primarily to ensure accuracy and impartiality. Countless news pieces around the world have been seen hailing the effective use of DNA in solving heinous crimes. For example, in the United States of america, there are many precedents, as the DNA testing and database is largely used in there. A quick example in this regard is that in 1999, Authorities in New York used DNA evidence to connect a guy to at least 22 heinous sexual assaults and robberies that shocked the city. DNA evidence was utilized by authorities in Philadelphia, Pennsylvania, and Fort Collins, Colorado, in 2002 to connect and solve a series of crimes (rapes and a murder) committed by the same person. The 2001 "Green River" homicides were unsolved for years despite the efforts of a massive law enforcement task force. A crucial breakthrough was made thanks to DNA evidence.

Despite its many drawbacks, the technique is unique in that its greatest value to society is the ability of DNA profiling to exclude the innocent. It also demonstrates a significant improvement in its capacity to convict the guilty. The courts, as well as the general public, must have a thorough understanding of technology. As evidenced by the current patent fight, the technology is also valuable in the sense that it has become a commercially valuable property. A survey of forensic professionals found widespread dissatisfaction with lawyers' lack of scientific expertise. Before the trial, the lawyers and judges are given advanced scientific training that will benefit them in their decision-making. Before a trial, lawyers and judges should be educated on complex scientific material that will aid them in comprehending the DNA profile and its evidentiary value in the criminal justice system.

References

Afridi, N. (2021). The Current Status of Forensic Science and its Impact on Administration of Criminal Justice System in Pakistan: An Analytical Study. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3781586.

Campbell and Cosans v. United Kingdom. (1982). Though the mere threat may itself conflict with art 3; Kruslin v. France (1990) 12 EHRR 54

Doleac, J. L. (2017). The Effects of DNA Databases on Crime. *American Economic Journal: Applied Economics*, *9*(1), 165-201. https://doi.org/10.1257/app.20150043.

Guillen, M., Lareu, M. V., Pestoni, C., Salas, A., & Carracedo, A. (2000). Ethical-legal problems of DNA databases in criminal investigation. *Journal of Medical Ethics*, *26*(4), 266-271. https://doi.org/10.1136/jme.26.4.266.

Mapes, A. A., Kloosterman, A. D., & de Poot, C. J. (2015). DNA in the criminal justice system: the DNA success story in perspective. *Journal of forensic sciences, 60*(4), 851-856.

Martin, P. D., Schmitter, H., & Schneider, P. M. (2001). A brief history of the formation of DNA databases in forensic science within Europe. *Forensic Science International*, *119*(2), 225-231. https://doi.org/10.1016/s0379-0738(00)00436-9.

Maryland v. King (2013). Supreme Court Allows Warrantless Search and Seizure of Arrestee's DNA. 133 S. Ct. 1958.

Parven, K. (2013). Forensic Use of DNA Information V. Human Rights and Privacy Challenges. *University of Western Sydney Law Review, 17*, 41.

Rasool, N., & Rasool, M. (2020). DNA evidence in sexual assault cases in Pakistan. *Medicine, Science and the Law, 60*(4), 270-277.

Simoncelli, T. (2006). Dangerous Excursions: The Case against Expanding Forensic DNA Databases to Innocent Persons. *Journal of Law, Medicine & Ethics*, *34*(2), 390-397. https://doi.org/10.1111/j.1748-720x.2006.00045.x.

Singh, S. C. (2011). DNA PROFILING AND THE FORENSIC USE OF DNA EVIDENCE IN CRIMINAL PROCEEDINGS. *Journal of the Indian Law Institute, 53*(2), 195-226. http://www.jstor.org/stable/43953503

Urbas, G., & GANS, J. (2002). DNA identification in the criminal justice system. *Trends and issues in crime and criminal justice*, (226), 1-6.

Whittall, H. (2008). The forensic use of DNA: Scientific success story, ethical minefield. *Biotechnology Journal*, *3*(3), 303-305. https://doi.org/10.1002/biot.200800018.