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RESEARCH ARTICLE

The Intersection of Law and Forensic Science: Evaluating DNA Evidence in Tom v S

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ABSTRACT

This article presents a case study demonstrating the significance of DNA evidence in forensic investigations. DNA, widely accepted as a reliable method for verifying human identity, especially in criminal investigations within South Africa, is a beacon of reliability in the legal system. Its objectivity and exceptional discriminatory power underscore its pivotal role, reinforcing its role in supporting accurate and just legal decisions. A striking instance is the recent case before the Supreme Court of Appeal Tom v S, where the prosecution's case hinged firmly on DNA evidence with some sup- porting circumstantial evidence. The appellant, who denied the crime and provided an alibi defence, was found guilty. This case led to a life sentence for rape, with concurrent sentences for additional charges, demonstrating the practical significance of DNA evidence in the legal system. The appellant later appealed his convictions, highlighting the importance of reliable, relevant, and admissible DNA evidence in court. This case is a prime example of how courts may convict an accused based on DNA evidence and some supporting circumstantial evidence, provided it meets these criteria. The article also delves into the legal considerations surrounding using DNA evidence in criminal cases, discussing its application, challenges, and implications for the justice system.

INTRODUCTION

Forensic DNA analysis has significantly contributed towards the criminal justice system (Bell and Butler 2022; Haddrill 2021; Hoffmann et al. 2024; Oosthuizen and Howes 2022). As a powerful investigative tool, forensic DNA aids in both excluding innocent individuals and associating perpetrators to physical evidence, ultimately strengthening the justice system and reinforcing public confidence in forensic science (Bell and Butler 2022; Bukyya et al. 2021; Butler 2015; Machado and Silva 2019; Smith and Horne 2023a; Wickenheiser 2021). DNA analysis is based on solid theoretical principles (Keerti and Ninave 2022). However, the reliability of DNA evidence depends on multiple factors, including but not limited to the sample quality, proper handling procedures, method validation, instrument accuracy, and the expertise of forensic analysts (Alketbi 2024; Smith and Horne 2023b). Contamination, human error, and challenges in analysing degraded or mixed samples can significantly compromise DNA integrity, potentially leading to miscarriages of justice (Balk 2015; Meintjes-van der Walt and Dhliwayo 2021; National Research Council 2009, Sikorski 2022; Smith and Horne 2023b). There is a necessity for stringent laboratory protocols, ethical safeguards, and continuous advancements in forensic science. Additionally, while DNA evidence is often perceived as infallible, forensic scientists must carefully assess its probative value to avoid over-reliance. Another critical concern is bias in forensic examinations and evidence. Forensic evidence users, including judges, jurors, police, and lawyers, often lack the scientific expertise to evaluate methods critically, and misleading sources like entertainment and news media often influence their perceptions of forensic

evidence (Alfaro et al. 2025). Cognitive biases like tunnel vision and confirmation bias can influence how DNA evidence is collected, analysed, and interpreted. This may lead forensic experts to unconsciously favour the prosecution's perspective, increasing the likelihood of wrongful convictions (Alfaro et al. 2025; Findley 2012; Jeanguenat et al. 2017). Supporting objective forensic analysis requires ongoing training, blind testing procedures, and robust quality control measures.

To demonstrate the importance of the factors mentioned, an analysis on the *Tom v S* case was done. The study employed an investigative descriptive method, reviewing recent literature on DNA evidence to illustrate its credibility and the legal impact. In the case of *Tom v S,* DNA analysis linked the accused to a crime three years after the incident through a match in the National Forensic DNA Database. The forensic DNA investigative lead played a crucial role in securing the suspect's arrest and ultimate conviction for rape and other offenses. This case underscores the decisive influence of forensic DNA in criminal trials while also highlighting the need for careful interpretation of genetic evidence within the legal system. This study employs an investigative descriptive method. It reviews recent literature on DNA evidence and presents a case study to illustrate its credibility and legal impact.

2. Background of the Case Study

On the evening of November 2, 2015, the victim was confronted by an intruder in her home in the Lower Gwalane area, Peddie district. The intruder violently covered her head with a blanket, struck her with a solid object when she resisted, and discharged a firearm, injuring her foot. He demanded money, knowing she kept funds for a local "tea association." After obtaining the money, the intruder sexually assaulted her and threatened harm to her son, who was at school preparing for exams. He also inquired about her husband's whereabouts (*Tom v S*).

The intruder attempted to destroy evidence, including his DNA, by washing the victim with kitchen water. However, despite his efforts, DNA from a semen stain was found on the victim's sweatpants. DNA tests excluded two community members as suspects. The case remained unsolved until three years later, when the defendant was arrested in the Western Cape on unrelated charges. The A reference DNA sample from the appellant matched the DNA profile of semen found on the victim's clothing (*Tom v S*).

According to the victim, she did not personally know the appellant, having only seen him briefly in town. She could not recognize his voice, as he had never visited her home. The appellant presented an alibi, claiming he only returned to his family home in late December 2015. The defence argued that the victim's testimony, particularly her claim of not knowing the appellant, was untrustworthy, pointing to his knowledge of where the water was stored (*Tom v S).*

Water is commonly stored in kitchen containers in this community. During the appeal, the appellant claimed he did not know where to obtain water. However, the modest size of the victim's four-room house and the undisputed water availability in the kitchen were cited as circumstantial evidence supporting the DNA findings. It was also suggested that an unfamiliar intruder would have struggled to locate the kitchen without assistance (*Tom v S).*

The trial court found the appellant's alibi questionable, particularly given his proximity to the crime scene. The appellant's family home was in the same village, and the victim testified that she could see it from her house. Despite working in Cape Town and rarely visiting the village, the appellant had been seen there shortly after the incident. Furthermore, his knowledge of the victim's son's school plans and his inquiries about her husband suggested he was familiar with the community, supporting the complainant's account (*Tom v S).*

This case underscores the critical role of DNA evidence in confirming the defendant's identity and overcoming challenges to witness testimony and alibis. The DNA match, combined with the appellant's geographic proximity and the details of the crime, played a pivotal role in securing the conviction.

RESEARCH METHODOLOGY

This study utilized a qualitative, non-empirical research approach, primarily adopting a systematic and investigative descriptive methodology. It involved a comprehensive review and critical assessment of recent academic literature on DNA evidence. A key reference in this analysis is a recent High Court ruling in the appeal case *Tom v S,* in which DNA evidence played a pivotal role alongside other corroborative circumstantial evidence. The central research question examined whether an individual can be convicted solely based on the assertion that they are the source of genetic material found on a crime scene exhibit. Through an investigative descriptive approach, this study evaluates the reliability of DNA evidence and its legal implications.

DISCUSSION

In South Africa, DNA evidence is widely recognised and accepted as a crucial tool for forensic investigations. It is extensively used to verify human identity and establish associations between suspects and criminal activities, often in conjunction with other circumstantial evidence (Lubaale 2015; Meintjes- van der Walt and Dhliwayo 2021). In South Africa, the inadequate handling of DNA exhibit material, the absence of forensic evidence and expert testimony have been identified as primary contributors to false convictions (Shumba 2017). The significance of DNA evidence in criminal investigations cannot be overstated, as it provides objective and highly discriminative data that reinforce its pivotal role within the legal system. A notable example is the Supreme Court of Appeal case *Tom v S,* where DNA and corroborative evidence, played a decisive role in securing a conviction. In this study, we will focus on the scientific credibility and the admissibility of the DNA evidence, as well as the confirmation of the identity, the statistical consideration and the evidential value of the DNA evidence presented.

Scientific credibility of DNA evidence

Modern forensic DNA analysis relies short tandem repeat (STR) loci to ensure consistency and accuracy (Asogawa et al. 2020; Butler 2015; Mei et al. 2021). Forensic DNA profiles are uploaded to databases such as the National Forensic DNA Database of South Africa, where they are compared against known profiles to identify potential associations. Once an association is identified, further investigative analysis is conducted to determine the person of interest's involvement in the crime (Butler 2015; Smith 2022; Smith and Horne 2023a). Forensic DNA databases have proven instrumental in solving certain cold cases, identifying serial offenders such as in sexual offences, and linking perpetrators to prior crimes (Smith 2022; Smith and Horne 2023a).

In the case study *Tom v S*, DNA evidence collected from a semen stain found on the pants of the victim, formed the cornerstone of the conviction. Biological samples such as blood, saliva, and seminal fluid collected from crime scenes and victims provide crucial forensic evidence, provided that proper collection, documentation, and preservation protocols are followed (de Wet et al. 2011; Smith and Horne 2023b; Meintjes-van der Walt and Dhliwayo 2021). DNA analysis is widely regarded as one of the most reliable forensic tools due to its strong scientific foundation, rigorous validation processes, and extensive peer-reviewed research supporting its use in criminal investigations (Badiye et al. 2020; Butler 2015; Jordan and Mills 2021; Kaye 2019; PCAST 2016). Its reliability is maintained through strict adherence to validated forensic methodologies and ro- bust quality assurance and control measures (Butler 2005). Regular proficiency testing ensures that laboratory analysts maintain high competence levels, while independent peer review through accreditation supports compliance with international forensic standards. Supporting conformance to these measures contributes to fostering confidence in the validity and reproducibility of forensic DNA evidence. Meintjes-van der Walt (2008) rightly argues that accreditation alone does not ensure ongoing compliance or eliminate the possibility of errors. From a quality assurance perspective, it is more crucial to assess the effectiveness of existing quality control measures and determine whether they are sufficient to produce valid and reliable results.

Despite its reliability, DNA evidence is not infallible. Factors such as human error may impact the reliability of DNA evidence (Sikorski 2022). In the USA, the President's Council of Advisors on Science and Technology (PCAST) report (2016) affirmed the accuracy of single-source and simple mixture.

DNA analysis. Still, it raised concerns about interpreting complex DNA mixtures and low-template samples. The integrity of DNA evidence begins at the crime scene. Proper collection, handling, storing, labelling, and documentation are critical to preventing contamination or degradation of DNA exhibit material. Improper handling of DNA exhibit material can compromise results, potentially affecting the investigation. Maintaining a well-documented chain of custody is essential to establishing the authenticity of DNA evidence from the crime scene to the courtroom. Each instance of evidence handling must be recorded to ensure that the DNA evidence presented in court is unaltered and credible (Meintjes-van der Walt and Dhliwayo 2021). DNA exhibits material that is of poor quality, low quantity, or contains a mixture of multiple contributors pose significant interpretive challenges (Murphy 2015; Murphy 2018; PCAST 2016).

The National Academy of Sciences report, Strengthening Forensic Science in the United States: A Path Forward, underscores the necessity for forensic examinations and findings to be based on sound scientific principles, including proper statistical analysis of DNA evidence (NRC 2009). Objectivity and accuracy must remain at the forefront of forensic DNA analysis and interpretations to ensure that results reflect actual case circumstances. However, complete objectivity remains challenging. A forensic analyst's may exhibit contextual bias and their interpretation of evidence may be influenced by extraneous information about a case. Research has demonstrated that due to the complexity of DNA mixture interpretation, contextual bias can influence the interpretation, leading to potential misinterpretations (Dror and Hampikian 2011; Perlin 2015). It is essential to consider and address all factors that could affect the credibility of forensic DNA evidence.

While DNA evidence is a powerful tool for implicating the guilty and exonerating the innocent, this perception can lead to an overdependence on DNA, which results in criminal convictions. Such reliance may overshadow other critical evidence and considerations, potentially resulting in miscarriages of justice. It's essential to recognize that a balanced approach to all evidence is crucial, including DNA evidence (Olaborede and Meintjes-van der Walt 2020; Young 2022). In the *Tom v S* case, the DNA evidence was found to be the cornerstone of proving the case. The scientific credibility of the evidence and the quality control measures of the forensic sciences facility were considered and found to be reliable. Thus, together with the circumstantial evidence, it was enough to prove the state version of events.

Statistical considerations in DNA evidence

Interpreting DNA evidence requires a robust statistical framework to assess the significance of a match. One of the critical aspects of legal proceedings is the statistical weight of DNA evidence (Daeid et al. 2017). The probability of a random match within a given population provides contextual insight into the evidentiary value of DNA findings. Should a match occur between the forensic DNA profile of the DNA exhibit material and a reference sample, a calculation is performed to determine the random match probability and/or likelihood ratio for that match. In mixed DNA profiles, the combined probability of exclusion/inclusion is calculated instead. To calculate these statistics, the frequency of each allele (and genotype) occurring in the forensic DNA profile of interest needs to be determined and then multiplied to obtain the DNA profile frequency (Lucassen et al. 2021; Meintjes-van der Walt 2010).

The CPI method operates as a binary model, considering alleles as either present or absent (Lucassen et al. 2021). The interpretation of forensic DNA profiles and the calculation of the statistical weight of DNA evidence involve three stages: i) Evaluation of the forensic DNA profile; ii) Comparison with reference profiles and inclusion/exclusion determination, and iii) Calculation of the statistical significance of a match (Bieber et al. 2016).

The inclusion or exclusion of an individual in a forensic DNA profile depends on the presence of all expected alleles. The absence of even a single expected allele results in exclusion. However, a limitation of the CPI method is that allelic dropout can sometimes be misinterpreted as an exclusion (Lucassen et al. 2021). A DNA profile with rare allele combinations strengthens the evidentiary value, whereas more commonly occurring profiles reduce the probative weight of the evidence.

To enhance statistical accuracy, forensic analysts rely on population reference databases that contain allele frequency distributions for various racial and geographic groups (Heathfield et al. 2024; Lucassen et

al. 2014). Forensic reports must provide comprehensive documentation of the DNA findings, including the analytical methods and statistical models used to substantiate the results. These statistical evaluations address two key forensic questions: i) What is the probability that a crime scene DNA sample could randomly match someone other than the suspect? and ii) How likely is it that another individual in the population could have the same DNA profile?

In South Africa, the DNA profile's rarity is quantified by its frequency in the population, with the case study's DNA profile having a 1.6×10^{12} chance of matching a random individual (*Tom v S*) The probability of a DNA match is calculated using the frequencies of alleles from the major specific population groups in South Africa, and the most conservative CPI is reported, reinforces the strength of the evidence. DNA analysis often involves mixed-source samples contributed by multiple individuals, presenting additional challenges. The CPI model has been criticised for its lack of accuracy in complex mixture interpretation and low-template DNA analysis (Perlin 2015). To enhance statistical reliability, forensic casework increasingly employs advanced probabilistic genotyping methods to address challenges such as allelic dropouts, peak height variations, and the analysis of complex DNA mixtures (Perlin 2015). These computational approaches utilize statistical algorithms to interpret intricate DNA profiles, thereby reducing subjectivity and improving accuracy in forensic analyses. Probabilistic genotyping systems have been developed to facilitate the interpretation of complex DNA evidence (Boodoosingh et al. 2024; Murphy 2018; Perlin 2015). These systems apply mathematical models to assess the likelihood of various genotype combinations, providing a more robust framework for analysing mixed or low-template DNA samples. Studies have demonstrated that probabilistic genotyping enhances the objectivity and consistency of DNA evidence interpretation, even in cases involving multiple contributors or degraded samples. The reliability of these systems reassures the forensic community of their value in standardizing DNA mixture analysis (Boodoosingh et al. 2024; Gill et al. 2021). .

Admissibility of DNA evidence

DNA evidence, with its potential to convict criminals, exonerate the wrongfully convicted, and provide links to perpetrators, carries the added weight of potentially preventing further violent crimes. Like any other form of evidence, its admissibility hinges on its probative value and relevance in influencing the probability of a contested fact (de Wet et al. 2011; Theophilopoulos and Bellengère 2022; Twomey et al. 2023).

For DNA evidence to be admitted in a court of law, it must comply with legal standards for admissibility. The court, as stipulated by the Criminal Procedure Act (51 of 1977) and aligned with Section 35(5) of the Constitution of the Republic of South Africa, plays a crucial role in assessing whether the evidence logically influences the contested issue (South Africa, 1977).

In the case of DNA evidence, the question often revolves around identifying the perpetrator, with the prosecution presenting the DNA found on the victim or the crime scene as a means of proving guilt. DNA evidence is considered expert evidence, relying on specialised knowledge, scientific methods, and technical principles. It must meet established criteria for expert testimony, including sufficient scientific validity and objectivity *(Tom v S*). The reliability of DNA evidence is assessed based on factors such as the validity and reliability of the DNA test method, the competency and proficiency of the forensic analyst, the integrity of the crime scene, the chain of custody, the validity of the statistical analysis, and the conclusions drawn from the evidence (Alketbi 2023; Butler 2005; Smith and Horne 2023b; *Tom v S*) Expert witnesses must have the qualifications, experience, and training necessary to provide testimony that is not generally available to the average person (Dumani 2005; Keysser 2024; Young and Goodman-Delahunty 2021).

In *S v SMM* the Supreme Court of Appeal affirmed the value of DNA evidence in confirming an offender's conviction, with DNA providing clear proof of the crime. Courts may rely solely on DNA evidence if it meets all admissibility requirements, including relevance, reliability, and scientific basis (Meintjes-van der Walt and Dhliwayo 2021). DNA analysis is considered more reliable than other forensic methods due to its high discriminatory power (Olaborede and Meintjes-van der Walt 2020). DNA evidence must also satisfy specific procedural and handling requirements to be admissible. The State must prove that the chain of custody was maintained and that the evidence was handled following proper protocols. In *S v Van Tonder,* the court ruled that any dispute regarding the chain of

custody must be resolved by demonstrating that the sample was sealed correctly and received in a tamper-proof condition. It is the State's responsibility to call the relevant witnesses to verify these procedures, underscoring the weight of their responsibilities.

Forensic evidence must meet the following three requirements to be deemed valid: i). The scientific community must accept the underlying scientific principle; ii). The method used must be reliable, with a well-established record of consistency; and iii). The technique must be appropriately applied to the specific facts of the case. These principles, derived from cases such as *Frye v. United States,* and *Daubert v. Merrell Dow Pharmaceuticals,* ensures that forensic evidence meets rigorous scientific standards before being admitted in court. Additional considerations include the qualifications of those conducting and interpreting the tests and using validated methods and equipment (Martin 1998). Forensic DNA examinations must be conducted and documented with rigorous precision to ensure that the evidence can subsequently be validated by any impartial scientist and the court (*S v Maqhina*).

As previously discussed, in South Africa, forensic DNA laboratories must comply with the standards set by the South African National Accreditation System (SANAS 2020) This system includes maintaining a documented quality system, proper personnel training, adherence to validated methods, and regular audits to ensure reliability (SANAS 2020). It ensures that forensic DNA evidence is handled consistently and accurately throughout the investigative process.

While DNA evidence can be highly persuasive in criminal cases, it must not be overstated. Overemphasis on DNA evidence can lead to wrongful convictions, particularly in cases where the evidence is misinterpreted or contaminated. Eliminating the possibility of contamination and errors in interpretation is critical to avoid unjust convictions (Meintjes-van der Walt and Dhliwayo 2021).

Although DNA profiling has been widely accepted in South African courts since its introduction in 1985, issues related to accreditation, quality assurance, chain of custody, and laboratory procedures continue to arise in some cases (Olckers and Hammatt 2021; *S v Van Breda*; *S v Maqhina*; *S v Orrie*). In *S v Orrie,* the defence pointed out procedural deviations, but the court determined that these were administrative errors and did not affect the accuracy of the results. However, such procedural lapses highlight the need for strict adherence to established protocols to avoid jeopardizing the integrity of DNA evidence (Olaborede and Meintjes-van der Walt 2020; Thompson 2012). In the *Tom v S* case, the DNA evidence was not challenged since the established criteria were found to be met, the DNA evidence was admitted in the court of law. However, in the appeal case, the court reviewed the DNA evidence.

Confirmation of Identification

In the appeal case under review, the court shifted its focus to the argument that DNA evidence, in isolation, was insufficient to support the appellant's conviction without corroborative testimony (*Tom v S*). This argument questions the weight the court should attribute to DNA evidence, with the fundamental task being to assess whether the State has adequately proven the appellant's guilt by the law. Understanding the limitations of DNA evidence is a complex task that requires a deep comprehension of what it does not prove. DNA evidence, when the question of identity is disputed, does not directly identify the perpetrator, as in this case. Instead, it can only suggest that a person may be the source of a genetic sample at the crime scene.

Determining whether a person is the DNA sample's source relies on analytical evidence, including the comparison of allele frequencies (the different forms of a gene that can exist at a single locus) or repeating patterns in the DNA samples (the sequence of nucleotides that are repeated in the DNA) (Zeffertt and Paizes 2017). The rarity of the DNA profile is assessed through the probability that a randomly selected individual would match the DNA profile in question. In South Africa, the frequency of genetic traits within specific reference groups is used to calculate this probability. The trial court's role is to assess the evidentiary value of the DNA analysis in light of this statistical context (Meintjes-van der Walt and Dhliwayo 2021).

In evaluating the evidentiary weight of DNA, the facts of the case, the characteristics of the DNA evidence, and relevant rules of evidence are considered. DNA evidence is often categorized as

circumstantial (Meintjes-van der Walt and Dhliwayo 2021; *Bokolo v S*). This involves providing evidence of facts from which the court is asked to infer another fact, such as the perpetrator's identity (*Bokolo v S*; *R v Mmthlongo*; Zeffertt and Paizes 2017). However, DNA evidence may be regarded as both direct (evidence that directly proves a fact) and circumstantial (evidence that provides a basis for inference about a fact): direct in the sense of the biological nature of the evidence, but circumstantial because the court must infer conclusions from it (*Komane v S;* Zeffertt and Paizes, 2017).

In *Godla v S,* the court underscored the importance of considering all relevant evidence collectively when evaluating circumstantial evidence. It is crucial to consider the combined effect of all the evidence presented, rather than focusing solely on individual pieces from the State or the accused. This comprehensive approach ensures that no crucial detail is overlooked. Ultimately, DNA evidence serves a powerful role in the legal process. It demonstrates that the accused's DNA matches that from the crime scene, allowing the court to infer that the accused may have committed the crime. While DNA evidence is circumstantial due to its indirect nature, it is a potent tool in establishing links between the accused and the crime.

In South Africa, the rarity of DNA profiles is quantified by their frequency in the population. In the *Tom v S* case, the DNA profile was found to have a 1.6×10^{12} chance of matching a random individual (*Tom v S*). The probability of a DNA match is calculated using the frequencies of alleles from the major specific population groups in South Africa, and the most conservative CPI is reported, reinforcing the strength of the evidence.

DNA evidentiary value

The evidentiary weight of DNA evidence in criminal cases depends on each case's context and the presence of other supporting evidence (*R v Sibanda and Others*). Forensic scientists should independently examine and document their interpretations of crime scene samples to mitigate confirmation bias in DNA analysis. Deviations should be justified and recorded. After this, known reference samples should be evaluated and compared to the crime scene data. When the prosecution uses DNA as critical evidence, it must prove the accused's guilt beyond a reasonable doubt (*Komane v S*; *S v Mahlalela*; *S v Ntsele*). In some cases, the State may rely on a collection of facts, none of which independently prove the conclusion, but when combined, they provide sufficient grounds to infer guilt (*R v Mthembu).* After considering all evidence, the court does not need to repeat detailed inferential reasoning (*S v Kesa and Another*).

In *S v Nyembe,* the court relied on DNA evidence in implicating the accused, sup- ported by similar factual evidence from three other related incidents. The totality of this evidence led to a conviction beyond reasonable doubt. The court held that an inference of guilt must be the only reasonable conclusion based on the facts, ruling out mere speculation or suspicion (*R v Blom*; *R v de Villiers*; *S v Mana*, *S v Vilakazi*). The court plays a crucial role in determining the value of DNA evidence. It must be evaluated holistically, not piecemeal *S v Reddy*, *Gcaza v S*; *S v Machi*; *Oosthuizen v S*).This comprehensive approach weighs the evidence pointing to the accused's guilt against that supporting their innocence, considering probabilities and possibilities (*S v Chabalala*). In an unreported case before the Brandfort Court (Brandfort CAS 111/06/2014), DNA evidence implicated the accused; however, the complainant excluded him as the perpetrator of the rape. It is suspected that the buccal DNA samples collected from the accused and other individuals in custody may have been inadvertently swapped. This case highlights the importance of corroborating DNA evidence with additional supporting evidence.

There is no legal requirement for DNA evidence to be corroborated by other evidence to be admissible, contrary to some interpretations (*Tom v S*). The court's determination of the DNA evidence's value on a case-by-case basis, similar to other circumstantial evidence, instils confidence in the legal system's ability to deliver justice. In *Bokolo v S*, several elements were emphasized in assessing DNA evidence's value: i). Proper collection and preservation of evidence; ii). Validation of the accuracy of electropherogram interpretation; iii). Confirmation of the functioning of analytical equipment; iv) Calculation of the match probability in context; and v). Consideration of all additional evidence presented. The Bokolo decision highlights that properly obtained and preserved DNA evidence is critical for supporting credibility. Contamination risks and proper handling must be considered (*Luthuli v S*; *Nkwanyana v S*).

DNA evidence's reliability depends on the sample's integrity throughout collection and analysis. For example, the DNA sample in the case study was uncontaminated and matched the accused's profile, with the appellant not challenging this fact during the appeal process (*Tom v S*). The sample's integrity from collection to laboratory analysis is paramount, and DNA profiling's accuracy is bolstered by statistical significance (Meintjes-van der Walt 2003).

In the case study, the complainant was wearing tights during the assault, establishing a direct link between her clothing and the sexual assault she endured. The complainant wore the same tights after the attack, eliminating the possibility of secondary transfer (*Tom v S).* The geographical proximity of the appellant to the crime, as indicated by the complainant's testimony, supports the DNA evidence. The appellant's familiarity with the area and interactions with the complainant substantiate the case. The complainant could not identify the appellant by voice, and she had no unique knowledge of her home's layout, thus weakening any counterarguments (*Tom v S).*

DNA source and DNA activity level

When DNA evidence is presented in court, distinguishing between source level and activity level propositions is not just important—it is crucial. This differentiation underpins DNA evidence analysis and guides forensic scientists, legal professionals, and students in forensic science and criminal justice. The source level addresses the question: "Whose DNA is this?" This analysis involves DNA profiling and comparison to a known reference sample. A forensic scientist reports the statistical weight of the DNA evidence, indicating the likelihood that the DNA originated from a specific individual rather than an unrelated person. The activity level addresses the question: "How did the DNA get there?" This concerns the mechanism of DNA transfer (primary, secondary, or tertiary transfer), its persistence, and potential degradation. Determining whether DNA was deposited through direct contact, indirect transfer, or environmental contamination is complex. It requires crime scene context, witness testimony, and experimental data—factors typically beyond the forensic scientist's expertise. The assessment of activity level is the court's responsibility, as it must be considered alongside other evidence (Gill et al. 2018; Taylor et al. 2018, van Oorschot et al. 2019).

Forensic scientists should avoid overreaching into activity-level interpretations, as speculative conclusions can mislead the court and support an incorrect version of events. The risk of misinterpretation underscores the responsibility and ethical duty of forensic scientists. Additionally, forensic scientists must be vigilant against cognitive and contextual biases when interpreting and reporting DNA evidence to ensure scientific objectivity and accuracy (Gill et al. 2018).

The determination of guilt or innocence falls outside the forensic scientist's role, as do the interpretation of activities and identifying the DNA source. It's important to note that forensic scientists should not express opinions on any proposition, regardless of its level. Instead, their responsibility is to evaluate and assign probabilities to their findings based on the given propositions within the case context, ensuring an impartial and objective process (Gill et al. 2018).

Quality control of forensic DNA testing facilities

South African forensic DNA testing facilities must implement a quality management system based on ISO 17025, in accordance with legislation (South Africa, 2013). The reliability of forensic DNA evidence is contingent on the rigorous implementation of quality assurance and quality control measures throughout the analytical process. Adhering to standardised protocols supports accuracy and minimises the risk of errors (Kloosterman, 2001). Equally important is the maintenance of scientific integrity, which requires that the significance of forensic DNA findings be appropriately interpreted and not overstated in legal proceedings. This underscores the ethical responsibility of forensic scientists and legal professionals in their work (Smith 2022).

Initiatives for continuous improvement and a robust risk program should complement this quality management system. In addition to internal audits, the quality management system should undergo routine external peer review as part of the accreditation process by the South African National Accreditation System (SANAS) (Smith and Horne 2023b). The SANAS TG42-03 criteria specify that the DNA technical leader must have extensive experience and complete the appropriate courses in DNA testing techniques (SANAS 2020). Failure to comply with SANAS requirements may lead to questioning the credibility of DNA test results. The DNA technical leader responsible for

implementing and sustaining DNA methods of the laboratory must continually ensure and verify that the internal validations of the testing methods and the execution of DNA testing are scientifically valid to produce reliable results. The DNA technical leader must bear overall responsibility for the reliability and validity of the DNA testing methods. In addition to the forensic analyst's responsibility to provide testimony regarding the testing and DNA results, the defence should be encouraged to subpoena the DNA technical leader in criminal proceedings to demonstrate the validity of the DNA testing methods and reliability.

CONCLUSION

DNA evidence is a critical tool in forensic investigations but must be interpreted within the broader context of all available evidence. While case law acknowledges that DNA findings may, under certain circumstances, be sufficient for conviction, forensic DNA analysis alone should not determine guilt or innocence. DNA evidence only supports the proposition that an individual may be the source of a biological sample found at a crime scene; it does not provide information about how or when the DNA was deposited.

The reliability and admissibility of forensic DNA evidence depend on strict adherence to scientific and procedural standards. The forensic analyst's competency and proficiency, laboratory protocols, method validation and reliable equipment functioning, crime scene integrity, chain of custody, and statistical interpretation are crucial in supporting accurate and legally valid findings. Equally important is the need for expert testimony presenting DNA findings to remain impartial. This objectivity is crucial in avoiding overstatements that could mislead the court or contribute to wrongful convictions. By maintaining rigorous scientific standards and legal safeguards, forensic DNA analysis is crucial in supporting the pursuit of justice (Smith el al, 2025).

Expert witnesses, including forensic scientists, play a pivotal role in ensuring the reliability and validity of forensic evidence. Their objective, honest, and impartial testimony within their area of expertise is crucial. As expert witnesses, forensic scientists must adhere to ethical guidelines, ensuring neutrality and independence. Courts should admit only forensic evidence that has been proven reliable and valid rather than relying solely on cross-examination and judicial discretion to assess its probative value.

Limitations of the Case Study

This case study does not address all the legal aspects of DNA testing but provides a brief overview to contextualise the case study. Furthermore, this study does not cover all the complex aspects of quality assurance and the factors influencing the validity, reliability, and acceptance of DNA evidence in court. The article does not claim to include all possible elements that should be considered to accept DNA evidence in court.

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Informed Consent

This study is a literature review, hence there is no informed consent authors had to obtain before collecting data for this study.

Conflict of Interest

Authors have no conflict of interest in this study.

Ethical Clearance

UNISA 0914: 22/025/2023 to 22/05/2026

Authorship contribution statement:

JHS: Conceptualization, Design, Methodology, Implementation, Writing- original draft and final editing. **KE:** Writing- review and editing. **JSH:** Writing- review and editing

REFERENCES

Alfaro, C., Mora, D., Hernández, M., and Quigley-McBride, A. (2025). A practical approach to mitigating cognitive bias effects in forensic casework. Forensic Science International: Synergy, 10:100569. https://doi.org/10.1016/j.fsisyn.2024.100569

Alketbi, S. (2023). The role of DNA in forensic science: A comprehensive review. International Journal of Scientific Research and Applications. https://doi.org/10.2139/ssrn.4550489

Alketbi, S. (2024). DNA contamination in crime scene investigations: Common errors, best practices, and insights from a survey study. Biomed J Sci & Tech Res, 58(5):50970-50982. https://doi.org/10.26717/BJSTR.2024.58.009223

Asogawa, M., Ohno, S., Nakagawa, E., Ochiai, Y., Katahira, M., Sudo, M., Osawa, M., Sugisawa, M., and Imanishi, T. (2020). Human short tandem repeat identification using a nanopore-based dns sequencer: a pilot study. Journal of Human Genetics, 65(1):21-24. https://doi.org/10.1038/s10038-019-0688-z

Badiye, A., Neeti, K., and Shrivastava, P. (2020). Forensic DNA evidence: from crime scene to conviction. In Forensic DNA Typing: Principles, Applications and Advancements, pages 69-86. Springer Nature, Tokyo, Japan. https://doi.org/10.1007/978-981-15-6655-4_4

Balk, C. (2015). Reducing contamination in forensic science. Themis: Research Journal of Justice Studies and Forensic Science, 3(1):12. https://doi.org/10.31979/THEMIS.2015.0312

Bell, S. and Butler, J. (2022). Understanding Forensic DNA. Cambridge University Press. https://doi.org/10.1017/9781009043311

Bieber, F., Buckleton, J., Budowle, B., Butler, J., and Coble, M. (2016). Evaluation of forensic DNA mixture evidence: protocol for evaluation, interpretation, and statistical calculations using the combined probability of inclusion. BMC Genet, 17:125. https://doi.org/10.1186/s12863-016-0429-7

Bokolo v S (483/12) [2013] ZASCA 115; 2014 (1) SACR 66 (SCA) (18 September 2013). https://www.saflii.org/za/cases/ZASCA/2013/115.html

Boodoosingh, S., Kelly, H., Curran, J., and Kalafut, T. (2024). An inter-laboratory comparison of probabilistic genotyping parameters and evaluation of performance on dna mixtures from different laboratories. Forensic Sci Int Genet, 71:103046. https://doi.org/10.1016/j.fsigen.2024.103046

Bukyya, J., Tejasvi, M., Avinash, A., Chanchala, H., Talwade, P., Afroz, M., Pokala, A., Neela, P., Shyamilee, T., and Srisha, V. (2021). DNA profiling in forensic science: A review. Global Medical Genetics, 8(4):135-143. https://doi.org/10.1055/s-0041-1728689

Butler, J. (2005). Forensic DNA typing: biology, technology, and genetics of STR markers. Academic Press, London, 2nd edition.

Butler, J. (2015). The future of forensic DNA analysis. Philosophical transactions of the royal society B: biological sciences, 370(1674):20140252 .https://doi.org/10.1098/rstb.2014.0252

Daeid, N., Rafferty, A., Butler, J., Chalmers, J., McVean, G., and Tully, G. (2017). Forensic DNA analysis: A primer for courts, volume DES4928 of Primers for Courts. The Royal Society. https://royalsociety.org/-/media/about-us/programmes/science-and-law/royal-society-forensic-dna-analysis-primer-for-courts.pdf

Daubert v. Merrell Dow Pharmaceuticals, Inc. (1993). Supreme Court of the United States. U.S. 579. https://supreme.justia.com/cases/federal/us/509/579/

de Wet, S., Oosthuizen, H., and Visser, J. (2011). DNA profiling and the law in South Africa. Potchefstroom Electronic Law Journal (PELJ), 14(4):71-207. http://dx.doi.org/10.4314/pelj.v14i4.6

Dror, I. and Hampikian, G. (2011). Subjectivity and bias in forensic DNA mixture interpretation. Science Justice, 51(4):204-208. https://doi.org/10.17159/1727-3781/2011/v14i4a2587

Dumani, M. (2005). Aspects of expert evidence in the criminal justice system. Master's thesis, University of Nelson Mandela.

Findley, K. (2012). Tunnel vision. In Cutler, B., editor, Conviction of the innocent, pages 303-324. American Psychological Association. https://doi.org/10.1037/13085-014

Frye v. United States, 293 F. 1013 (D.C. Cir. 1923)
Gcaza v S (1400/2016) ZASCA 92 (9 June 2017). https://www.saflii.org/za/cases/ZASCA/2017/92.html
Godla v S (A98/2009) [2011] ZAFSHC 46 (3 March 2011). https://www.saflii.org/za/cases/ZAFSHC/2011/46.html
Gill, P., Benschop, C., Buckleton, J., Bleka, , and Taylor, D. (2021). A review of probabilistic genotyping systems: Euroformix, dnastatistx and strmix™. Genes (Basel), 12(10):1559. https://doi.org/10.3390/genes12101559
Gill, P., Hicks, T., Butler, J. M., Connolly, E., Gusmão, L., Kokshoorn, B., Linacre, A., de Knijff, P., and Morling, N. (2018). DNA commission of the international society for forensic genetics (ISFG): Assessing the value of forensic biological evidence-guidelines highlighting the importance of propositions. Forensic Science International: Genetics, 36:189-202. https://doi.org/10.1016/j.fsigen.2018.07.003
Haddrill, P. (2021). Developments in forensic dna analysis. Emerging Topics in Life Sciences, 5(3):381-393. https://doi.org/10.1042/ETLS20200304
Heathfield, L., Nel, L., and Reid, K. (2024). Evaluation of the investigator® 24Plex Go! kit and associated allele frequency data for four South African population groups. Forensic Science International: Reports, 9:100357. https://doi.org/10.1016/j.fsir.2024.100357
Hoffmann, R., Meakin, G., Morelato, M., and Roux, C. (2024). The utility of trace DNA within forensic science for investigative and intelligence purposes. Wires: Forensic Science, page e1515. https://doi.org/10.1002/wfs2.1515
Jeanguenat, A., Budowle, B., and Dror, I. (2017). Strengthening forensic DNA decision making through a better understanding of the influence of cognitive bias. Science Justice, 57(6):415-420. https://doi.org/10.1016/j.scijus.2017.07.005
Jordan, D. and Mills, D. (2021). Past, present, and future of DNA typing for analyzing human and non-human forensic samples. Frontiers in Ecology and Evolution, 9:646130. https://doi.org/10.3389/fevo.2021.646130
Kaye, D. H. (2019). The Double Helix and the Law of Evidence. Harvard University Press. https://www.hup.harvard.edu/books/9780674035881
Keerti, A. and Ninave, S. (2022). Dna fingerprinting: Use of autosomal short tandem repeats in forensic dna typing. Cureus, 14(10):e30210. https://doi.org/10.7759/cureus.30210
Keysser, R. (2024). Retaining and using expert witnesses: A short primer. Bench Bar of Minnesota, 81(2):16.
Kloosterman, A. (2001). Credibility of forensic DNA typing is driven by stringent quality standards. *Accreditation Quality Assurance*, 6:409-414 https://doi.org/10.1007/s007690100372
Komane v S (2022) JOL 52949 (SCA). https://www.saflii.org/za/cases/ZASCA/2022/55.html
Lubaale, E. C. (2015). Bokolo v S 2014 (1) SACR 66 (SCA): The practicality of challenging DNA evidence in court. SA Crime Quarterly, 52:39-47. https://doi.org/10.17159/2413-3108/2015/i52a29
Lucassen, A., Ehlers, K., Grobler, P., and Shezi, A. L. (2014). Allele frequency data of 15 autosomal STR loci in four major population groups of South Africa. International Journal of Legal Medicine, 128:275-276. https://doi.org/10.1007/s00414-013-0898-4
Lucassen, A., Ehlers, K., Grobler, P. J., and Brenner, C. H. (2021). Evaluating mixture solution™-rapid and non-MCMC probabilistic mixture analysis. International Journal of Legal Medicine, 135:2275- 2284. https://doi.org/10.1007/s00414-021-02680-2
Luthuli v S (AR106/2020) [2021] ZAKZPHC 8 (29 January 2021). https://www.saflii.org/za/cases/ZAKZPHC/2021/8.html
Machado, H. and Silva, S. (2019). What influences public views on forensic DNA testing in the criminal field? A scoping review of quantitative evidence. Human Genomics, 13:23. https://doi.org/10.1186/s40246-019-0207-5
Machi v S (256/2020) [2021] ZASCA 106 (30 July 2021). https://www.saflii.org/za/cases/ZASCA/2021/106.html
Mahlalela v S (396/16) [2016] ZASCA 181 (28 November 2016). https://www.saflii.org/za/cases/ZASCA/2016/181.html
Martin, C. (1998). DNA profiling. De Rebus, pages 66-68.

Mei, S., Liu, Y., Zhao, C., Xu, H., Li, S., and Zhu, B. (2021). The polymorphism analyses of short tandem repeats as a basis for understanding the genetic characteristics of the population. BioMed Research International, pages 1-13. https://doi.org/10.1155/2021/8887244

Meintjes-van der Walt, L. (2003). The proof of the pudding: The presentation and proof of expert evidence in South Africa. Journal of African Law, 47(1):88-106. https://doi.org/10.1017/S0221855303001998

Meintjes-van der Walt, L. (2008). An overview of the use of DNA evidence in South African criminal courts. South African Journal of Criminal Justice, 21(1):22-62. https://journals.co.za/toc/jlc.sajcj/21/1

Meintjes-van der Walt, L. (2010). DNA in the Courtroom: Principles and Practice. Juta, Cape Town. https://hdl.handle.net/10520/EJC130599

Meintjes-van der Walt, L. and Dhliwayo, P. (2021). DNA evidence as the basis for conviction. Potchefstroom Electronic Law Journal, 24(1):1-37. http://dx.doi.org/10.17159/1727-3781/2021/v24i0a8537

Murphy, E. E. (2015). Inside the Cell: The Dark Side of Forensic DNA. Nation Books, New York, NY. https://doi.org/10.17159/1727-3781/2021/v24i0a8537

Murphy, E. E. (2018). Forensic DNA typing. Annual Review of Criminology, 1:497-515. https://doi.org/10.1146/annurev-criminol-032317-092127

National Research Council (NRC). (2009). Strengthening forensic science in the United States: A path forward. National Academies Press. https://www.ojp.gov/pdffiles1/nij/grants/228091.pdf

Nkwanyana v S (AR108/16) [2016] ZAKZPHC 82 (27 September 2016). https://www.saflii.org/za/cases/ZAKZPHC/2016/82.html

President's Committee of Advisors on Science and Technology (PCAST). (2016). Forensic science in criminal courts: Ensuring scientific validity of feature-comparison methods. Technical report, Executive Office of the President of the United States. https://www.justice.gov/d9/2023-07/07.13.23.%20-%20PCAST%20-%20Interim.pdf

Olaborede, A. and Meintjes-van der Walt, L. (2020). The dangers of convictions based on a single piece of forensic evidence. Potchefstroom Electronic Law Journal, 23(1):1-38. https://doi.org/10.17159/1727-3781/2020/v23i0a6169

Olckers, A. and Hammatt, Z. (2021). Science serving justice: opportunities for enhancing integrity in forensic science in Africa. Forensic Sciences Research, 6(4):295-302. https://doi.org/10.1080/20961790.2021.1989794

Oosthuizen and Another v S (180/2018) [2019] ZASCA 182; 2020 (1) SACR 561 (SCA) (2 December 2019). https://www.saflii.org/za/cases/ZASCA/2019/182.html

Oosthuizen, T. and Howes, L. (2022). The development of forensic DNA analysis: New debates on the issue of fundamental human rights. Forensic Science International: Genetics, 56:102606. https://doi.org/10.1016/j.fsigen.2021.102606

Perlin, M. (2015). Inclusion probability for DNA mixtures is a subjective one-sided match statistic unrelated to identification information. Journal of Pathology Informatics, 6(1):59. https://doi.org/10.4103/2153-3539.168525

R v Blom (1939) AD.

R v De Villiers (1944) AD 493.

R v Mthembu (1950) 1 SA 670 (A).

R v Mthlongo (1949) 2 SALR.

R v Sibanda and Others (1965) 4 SA 241 (RA).

South Africa. (1977). Criminal Procedure Act (No. 51 of 1977). Government Printers.

South Africa (1996). Constitution of South Africa (No. 108 of 1996). Government Printers.

South African National Accreditation System (SANAS). (2020). SANAS TG 42-03 technical guideline for forensic DNA testing laboratories. Technical report, South African National Accreditation System. https://www.sanas.co.za/Publications%20and%20Manuals%20Files/TG%2042-03.pdf

Shumba, T. (2017). Litigating innocence: the problem of wrongful convictions and absence of effective post-conviction remedies in South Africa. South African Journal of Criminal Justice, 30(2):179-197. https://hdl.handle.net/10520/EJC-a96e0bbb7

Sikorski, M. (2022). Is forensic science in crisis? Synthese, 200(3):188. https://doi.org/10.1007/s11229-022-03685-z

Smith, J. H. (2022). Forensic DNA investigation. In H.R. Dash, P. Shrivastava, J. L., editor, Forensic Science, pages 3-28. Springer Nature, Tokyo, Japan. https://doi.org/10.1007/978-981-16-4318-7_57

Smith, J.H. and Horne, J.S. (2023a). The value of forensic DNA investigative leads in South Africa. Journal of Forensic Science and Criminal Investigation, 17(4):555969. https://juniperpublishers.com/jfsci/pdf/JFSCI.MS.ID.555969.pdf

Smith, J.H. and Horne, J.S. (2023b). Die belangrikheid van gehaltebestuurstelsels in forensiese DNS- toetslaboratoria in Suid-Afrika. Litnet Akademies, 20(3). https://doi.org/10.56273/1995-5928/2023/j20n3b12

Smith, J.H., Horne, J.S., de Wet, G.J., Singh, M., Zeye, M.M.J., and Simon, K. (2025). Forensic DNA Expert Evidence in the South African Context. African Journal of Legal Studies. 1-27

South Africa (2013). Criminal Law (Forensic Procedures) Amendment Act, Act No. 37 of 2013. Government Gazette of South Africa. Legislation of South Africa.

S v Chabalala (2003) 1 SACR 134 (SCA).

S v Kesa and Another (CC19/2020) [2023] ZAECMHC 6 (13 February 2023). https://www.saflii.org/za/cases/ZAECMHC/2023/6.html

S v Maqhina (2001) 1 SACR 241 (T). https://www.saflii.org/za/cases/ZAGPPHC/2014/163.pdf

S v Mana (201/08) [2008] ZASCA 88; [2009] 1 All SA 143 (SCA) (11 September 2008). https://www.saflii.org/za/cases/ZASCA/2008/88.html

S v Ntsele (1998) 2 SACR 178. https://www.saflii.org/za/cases/ZAGPJHC/2019/69.pdf

S v Nyembe (JPV 2011/250) [2013] ZAGPJHC 126; 2014 (1) SACR 105 (GSJ) (29 May 2013). https://www.saflii.org/za/cases/ZAGPJHC/2013/126.html

S v Orrie and Another (SS 32/2003) [2004] ZAWCHC 25; 2005 (1) SACR 63 (C); [2005] 2 All SA 212 (C) (14 October 2004). https://www.saflii.org/za/cases/ZAWCHC/2004/25.html

S v Reddy and Others (416/94) [1996] ZASCA 55 (28 May 1996). https://www.saflii.org/za/cases/ZASCA/1996/55.html

S v SMM [*2013*] ZASCA 56; *2013* (*2*) *SACR 292* (*SCA*).

S v Van Breda (SS17/16) [2018] ZAWCHC 87 (7 June 2018). https://www.saflii.org/za/cases/ZAWCHC/2018/87.html

S v Van Tonder (1976) 3 SA 391 (T).

S v Vilakazi (576/07) [2008] ZASCA 87; [2008] 4 All SA 396 (SCA) ; 2009 (1) SACR 552 (SCA); 2012 (6) SA 353 (SCA) (3 September 2008). https://www.saflii.org/za/cases/ZASCA/2008/87.html

Taylor, D., Kokshoorn, B., and Biedermann, A. (2018).Evaluation of forensic genetics findings given activity level propositions: A review, Forensic Science International: Genetics, 36:34-49. https://doi.org/10.1016/j.fsigen.2018.06.001

Theophilopoulos, C. and Bellengère, A. (2022). Relevance, admissibility and probative value in a rational system of evidence: A South African perspective. Potchefstroom Electronic Law Journal, 25(1):58. https://doi.org/10.17159/1727-3781/2022/v25i0a11966

Thompson, W. (2012). Forensic DNA evidence: The myth of infallibility. In Genetic explanations: Sense and nonsense, pages 227-255. Harvard University Press. https://doi.org/10.4159/harvard.9780674067769.c19

Tom v S (CA 01/2021) [2022] ZAECMKHC 98; 2023 (2) SACR 283 (ECMk) (29 November 2022). https://www.saflii.org/za/cases/ZAECMKHC/2022/98.html

Twomey, M., Barnes, J., Hackett, J., and Ebrahima, M. (2023). A practical approach to evidence for judicial officers - Common law sources and African application. Judicial Institute for Africa (JIFA) Cape Town. file:///C:/Users/04237463/Downloads/A%20Practical%20Approach%20to%20Evidence%20for%20Judicial%20Officers-2.pdf

van Oorschot, R.A.H., Szkuta, B.; Meakin, G.E.; Kokshoorn, B.; Goray, M. (2019). Understanding DNA transfer: A review of the case of primary, secondary, and further transfer. Forensic Science International: Genetics, 40:24-34. https://doi.org/10.1016/j.fsigen.2018.10.014

Wickenheiser, R. (2021). The value of forensic DNA leads in preventing crime and eliminating the innocent. Forensic Science International: Synergy, 3:100201. https://doi.org/10.1016/j.fsisyn.2021.100201

Young, G. and Goodman-Delahunty, J. (2021). Revisiting Daubert: judicial gatekeeping and expert ethics in court. Psychological Injury and Law, 14(4):304-315. https://doi.org/10.1007/s12207-021-09428-8

Young, M. (2022). Law vs Science: Genomic evidence, wrongful convictions and the requirement for a statutory framework. Canberra Law Review, 19:1. https://www5.austlii.edu.au/au/journals/CanLawRw/2022/2.html

Zeffertt, D. and Paizes, A. (2017). The South African Law of Evidence. LexisNexis, Johannesburg, 3rd edition.