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## Contracting Forensic DNA Experts by the Defense in Hungarian Criminal Procedure<sup>1</sup>

### Abstract

Most of the studies published in Hungary on the judicial expert system and expert evidence in criminal proceedings do not deal with the question whether the availability of forensic DNA experts is adequate for the defense. This paper examines the current legal environment and focuses on this question. The study also gives a brief overview of the circumstances when DNA analysis plays an essential role in criminal cases. Finally, the article will show whether the defense can employ its own forensic DNA expert in criminal cases.

**Keywords:** forensic DNA analysis, contracted expert, expert employed by the defense, evidence, criminal procedure

### Introduction

Benjamin Franklin stated *'it is better 100 guilty persons should escape than that one innocent person should suffer'*. We must agree with him, even after three centuries. The failure of a criminal justice system is also obvious if a guilty person is acquitted. However, the conviction of a person for a crime he or she did not commit is an absolute tragedy. Criminal justice systems seek to introduce guarantees that help to prevent or, if the injustice has already occurred, at least explore miscarriages of justice worldwide. The most famous initiative is the Innocent Project started in the United States of America (USA) in 1992. This project exonerates the wrongly convicted through forensic DNA<sup>2</sup> testing and reforms the criminal justice system to prevent future injustices. The original

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<sup>2</sup> Deoxyribonucleic acid.

project has been running at Cardozo Law School in New York city, but the successful program has found followers all over the world (Korinek, 2017). To be able to effectively defend in a criminal court, or operate a program such as the Innocent Project, an appropriate legal environment is essential that allows the defense to provide DNA testing. Naturally this does not mean that a defense should have their own DNA laboratory or that the law should allow the admissibility of forensic DNA expert reports from any source. Neither, the free access to criminal evidence, that holds the possibility of manipulation, can be permitted. Nevertheless, if the law poses obstacles for the defense to verify faulty or misleading evidence, the situation provides the possibility of an unfair trial.

## **Expert evidence in criminal cases**

In any occasion when answering a legally relevant question requires special scientific knowledge or special expertise, an expert should be involved in the criminal case.

In common law countries, where an adversarial system is used, the accusation and the defense represent their position before an impartial person or group of people (a judge or jury), who attempt to determine the truth and pass judgment accordingly. Since they are equally strong combatants on court, both the accusation, and the defense party can call its own expert witness to help in proving the party's truth. Here, being an 'expert' is not a job title, but rather the designation of a type of witness and the form that his testimony may take (Turner, 2013). Traditionally there is no limitation how many experts are involved by the parties unless it is not obstructing the procedure and is not intended to unnecessarily prolong the proceeding.

In civil law countries, the judge presides over the trial and the judge decides on criminal liability. The case is built up by the prosecutor, while the contribution of the defense to the building of the case is limited. The system is governed by the principle of freedom of evidence, therefore with a few exceptions, all forms of evidence is admissible. Experts are mostly official, registered experts, sometimes included on lists. During the trial, experts are usually examined by the judge, who thus has an active role and takes a more directive approach than in the common law systems. The defense is not completely cut off from the expert reporting process, since it is usually possible for them to make a request for appointing an expert, to make comments on the expert's report, to raise supplementary questions and possibly request the appointment of an expert to give a second opinion, to request the expert at the hearing to clarify

material which is still unclear (Champod & Vuille, 2011). Even if the defense's influence is limited to the course of the case, most countries recognize the right of the defendants to employ their own experts and to submit an expert opinion prepared based on contract between the defense and the expert. This right seems to be significant, since incorrect expert opinions may lead to wrongful conviction, and the expert employed by the defense - who is professionally trained in the same field as the expert assigned by the state authorities – might be able to highlight these errors. With that in mind it is undoubtedly an opportunity that is one of the manifestations of the principle of equality of arms.

## **The judicial expert and the concept of equality of arms**

Equality of arms is an inherent feature of a fair trial. It requires a fair balance between the parties – the defense and the prosecution. To the fulfillment of this principle, the opportunity must be given to the parties to have knowledge of and comment on all evidence adduced or observations filed with a view to influencing the court's decision (Brandstetter v. Austria, § 67). Naturally, the principle of equality of arms is also relevant in the matters related to the appointment of experts in the proceedings. However, the European Court of Human Rights has found that the requirement of a fair trial does not impose on a trial court an obligation to order an expert opinion merely because a party has requested it (Huseyn and Others v. Azerbaijan, § 196). But, if there are experts employed from both sides, there must be an equal treatment between the expert for the prosecution and the expert called by the defendant (Bönisch vs Austria). The Court also stated that the rules on admissibility of evidence must not deprive the defense of the opportunity to challenge the findings of an expert effectively, in particular by introducing or obtaining alternative opinions and reports. In certain circumstances, the refusal to allow an alternative expert examination of material evidence may be regarded as a breach of Article 6 § 1 of the European Convention on Human Rights (Stoimenov v. the former Yugoslav Republic of Macedonia, § 38; Matytsina v. Russia, § 169) since it may be hard to challenge a report by an expert without the assistance of another expert in the relevant field (Khodorkovskiy & Lebedev v. Russia, § 187).

### *The forensic DNA expert report in criminal cases*

Wrongful convictions have been associated with various causes (Fenyvesi, 2014). It is beyond the scope of this study to examine them all. The central question

of this article is how forensic DNA analysis can prevent injustice or how it can point out that the conviction was wrongful. Particular emphasis is put on the question whether the defendant could obtain another DNA expert opinion, if the originally submitted one - ordered by the authorities - is not in their favor.

For a variety of reasons, DNA profiling has significantly advanced the analysis of biological stain evidence. DNA analysis is a powerful and often the only tool for establishing the presence or absence of someone at a crime scene. It is also one of the most precious tools in transnational fight against criminals (Prainsack & Toom, 2010). Shortly after its introduction, forensic DNA expert reports have occurred increasingly in criminal cases. Nowadays, thousands of DNA expert testimonies are presented to the criminal courts in Hungary every year (Pádár et al., 2019). However, while in domestic criminal procedure we encounter this kind of expert evidence usually only in criminal cases in progress, internationally, an unforeseen consequence of the introduction of DNA profiling has seen the reopening of old cases. The reason for this is that traditional forms of forensic evidence – handwriting analysis, fiber analysis, ballistics, blood-spatter analysis, bite-mark analysis – which rely upon expert judgement and have limited connection to established science, have been called into question in comparison with the new ‘gold standard’ of DNA profiling (Lynch, 2003).

The US National Academy of Forensic Science (NAS) released its report *‘Strengthening Forensic Science in the United States: A Path Forward’* in 2009 (URL1). The report primarily concluded that, except for nuclear DNA analysis, many commonly used forensic techniques had not undergone the necessary testing to establish sufficient validity and reliability to support claims made in court. Therefore, in many jurisdictions they started to re-examine evidence from the crime scene that in the time of their discovery could not have undergone DNA analysis.

However, there are cases when even a forensic DNA expert opinion raises questions about its usability or admissibility. Therefore, it can also assist in wrongly convicting somebody. This situation can occur for many reasons. One of them is the obvious fact, that at crime scenes, on objects and human body parts that may be linked to crimes the secured DNA sample is often a mix-DNA. This means that the evidence frequently contains DNA from several people. In June 2021, the National Institute of Standards and Technology (NIST) has published its draft report *‘DNA Mixture Interpretation: A Scientific Foundation Review’* (URL2). The report reviews the methods that forensic laboratories use to interpret evidence containing a mixture of DNA from two or more people. The NIST review shockingly states that currently *‘there is not enough publicly available data to enable an external and independent assessment of the degree*

*of reliability of DNA mixture interpretation practices, including the use of probabilistic genotyping software (PGS) systems.*' (URL1). The DNA expert can also be influenced by cognitive bias (Dror & Hampikian, 2011). Recently, experts have been also analyzing trace amounts of DNA, including 'touch DNA'<sup>3</sup> left behind when someone touches an object. These types of evidence can be far more difficult to interpret reliably than the 'relatively simple' DNA evidence typical of earlier decades. With 'traditional' DNA analysis, the results tend to be clear, either a suspect's DNA profile is found in the evidence or it is not. It is not too difficult even for laypeople to understand readily what that means. With DNA mixtures and trace DNA however, the results can be ambiguous and difficult to understand, sometimes even for genetics experts. In cases where the interpretation is difficult, inaccurate expert testimonies are more common. Therefore, in these cases, for the defense it is quite important to ensure access to an independent control inspection or check-interpretation.

Another problem is that DNA evidence can be contaminated when DNA from another source gets mixed with DNA relevant to the case. Because a DNA technology called Polymerase Chain Reaction (PCR) replicates or copies DNA in the evidence sample, the introduction of contaminants or other unintended DNA to an evidence sample can be problematic. If a sample of DNA is submitted for testing, the PCR process will copy whatever DNA is present in the sample; it cannot distinguish between a suspect's DNA and DNA from another source. DNA experts should be suspicious of results that do not fit with case circumstances, including a mixture that is not expected from the material processed and that is difficult to explain, based on their organization's valid interpretation guidelines. Re-testing the item may confirm that the profile is unrelated to the case. However, in many cases the contamination of samples may cause that an innocent person is associated with the crime.

Similarly, the problematics of DNA transfer can lead to a wrongful conviction. There have been several investigations of the primary transfer of DNA from a person to an object or another person and under what conditions primary DNA transfer can and will occur. It may also be possible that a perpetrator of a crime brings traces of another individual into a crime scene and deposits these traces via secondary DNA transfer. Secondary and multiple transfer occurs when DNA is transferred from one object or person to another via an intermediate object/person (Cale, Earll, Latham, & Bush, 2016). The notion that DNA could also be picked-up and transferred to somewhere else, and the potential

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3 'Touch DNA' is DNA obtained from biological material transferred from a donor to an object or a person during physical contact (Sessa et al., 2019).

implications thereof, was presented in the same Nature paper reporting the discovery of ‘touch DNA’ (Taylor, Kokshoorn & Biedermann, 2018). DNA transfer and contamination refer to the same physical phenomenon of DNA movement from one surface or location to another. It is basically the timing of this movement that defines whether DNA transfer is associated with a crime-related activity prior to securing a crime scene (be it pre-, during, or post-criminal activity), or a non-crime related contamination event during, or post-securing of a crime scene (Oorschot, Szkuta, Meakin, Kokshoorn & Goray, 2019).

In a forensic setting, non-crime related contamination can come in many forms and via different vectors. For example, a police officer at the scene, a scientist examining the evidence, a dirty examination tool, dirty crime scene bag or a non-DNA-free reagent used during sample analysis. Conversely, crime-associated DNA transfer refers to the movement of DNA from a source that may, or may not, be involved in the criminal activity, such as a perpetrator acting as a vector for the transfer of someone else’s DNA to the crime scene while performing a specific activity relevant to the crime. This someone else’s DNA could be that of an innocent individual (otherwise not associated with the offender, crime or crime scene) picked-up by the perpetrator during an interaction directly with that person, or an object that person had previously touched, just prior to the criminal activity taking place. While crime-associated DNA transfer occurs only before the crime scene is established by the authorities, contamination can only occur afterwards (Oorschot et al., 2019).

Mixed DNA, DNA contamination, DNA transfer and expert’s cognitive bias can mislead the expert. Oftentimes, only another expert can reveal such a mistake who is trained in the same field.

## **Expert contracted by the defense (‘private expert’) in Hungarian criminal proceedings**

It is necessary to clarify two different ways of using experts in the Hungarian criminal procedure. First, the expert can be assigned by the investigative authorities, by the prosecution and by the court - hereafter called assigned expert, or expert employed by the investigative authorities/prosecution/court. Second, an expert can also be contracted by the defense, hereafter called contracted expert or expert employed by the defense. The reason for avoiding the term ‘private expert’ for the latter, otherwise officially used in Hungarian legislation, will be explained later in the article.

According to Hungarian law, in all circumstances, if the establishment or evaluation of a fact to be proven requires special knowledge, an expert shall be employed. Experts may be assigned by the court, the prosecutor and by the investigating authority. The defendant and the counsel for the defendant may advise the state authorities to obtain an expert opinion. The defense also has the right to specify, who to assign as an expert. If the proposal to appoint an expert is rejected, the defense can mandate an expert itself. This also applies for situations, when the investigating authority or the prosecutor assigns a different expert than the defense has specifically asked for (Act No. XC of 2017 on Criminal Proceedings, § 188., § 190).

However, if the defense requests for the assignment of an expert to clarify a professional issue that was previously examined by another expert employed by the investigating authority or the prosecutor, the defense can contract an expert only if the following criteria are met:

- an objection was submitted by the defense which argues that the first expert's opinion is incomplete, unclear, contradicts itself or it is assumed to be incorrect for other reasons, and
- for this reason, the defense has asked for the clarification or completion of the expert opinion or has asked for the assignment of a new expert, but this request was rejected.

However, this rule does not apply, therefore no expert can be contracted, if the first expert was the one who was selected based on the defense's suggestion. Another limitation is, that the defense can employ an expert only once during the whole procedure (Act No. XC of 2017 on Criminal Proceedings, § 190). Thus, the law ignores the fact that even an expert who was assigned based on the defense's suggestion and the same one who was contracted by the defense, can submit an expert opinion that is considered as non-credible according to the defense. It is also clear from the legislation, that there is no possibility for the defense to submit a new expert opinion prepared by contracted expert as new evidence after the case is closed, so a re-trial is basically excluded on such a basis. That of course limits the defense's ability to provide new evidence concerning the convicted client's innocence. An additional limiting factor for the defense is the fact, that if the conditions described above have not been met, the opinion formed and written by the expert employed by the defense will count only as a comment. Accordingly, it will not be considered as evidence, at all.

Not surprisingly, arguments exist that the regulation concerning the defense's limited rights to use expert evidence violates the principle of equality of arms.

If the criteria described above are met, and the defense is allowed to submit an expert opinion prepared by the contracted expert, this expert is considered and called as ‘private expert’ according to the law. The ‘private expert’ shall be obliged and entitled to get acquainted with data only from the defense and his/her expertise cannot cause any setback in the work the expert assigned by state authorities. But, even if the expert is selected and paid by the defense based on a contract between them, we cannot call this expert an ‘expert of the defense’. This is because regarding the professional content of the expert opinion no instruction can be given to the expert by the defense. Every single profession rule and obligation that applies for the expert assigned by the authorities, applies also for those ones who are contracted by the defense. According to the legislation, the expert is always obliged to form an expert opinion with an objective assessment of the revealed facts (Act No XXIX of 2016 on Judicial Experts, § 52). If they are called to testify, they are also obliged to answer the question asked by the investigator, the prosecutor and the judge. Also, their ethical, disciplinary, and legal responsibilities are no less severe. For these reasons the present paper claims that the designation of ‘private expert’ is ambiguous since it erroneously suggests that the expert employed by the defense is biased in favor of the defendant by all odds. In fact, the expert should remain unbiased and objective, faithful to science and his/her profession in every circumstance, and these values should not be questioned without good reason.

## **The defendant’s right to obtain forensic DNA expert opinion**

Theoretically, a DNA expert can help a criminal defendant in four ways. First, an expert employed by the defense can search for possible error during the sample collection or by the forensic DNA testing laboratory appointed by the investigator, the prosecution, or the court. Second, they can testify at trial about the problems with DNA statistics and potentially offer the judge a lower probability estimate. Third, an expert employed by the defense can conduct independent tests on DNA samples (Deylin, 1998). Fourth, they can offer different explanation on how the DNA got into the crime scene.

Before we examine these four ways and whether there is a possibility in Hungarian law to make use of these opportunities, we have to look through the regulation on forensic DNA testing in Hungary.

Hungarian legislation permits examining of DNA in criminal cases exclusively for the National Expert and Research Center (NERC) and the institutes of legal medicine at medical schools. Even though there are four medical schools



with institute of legal medicine, in fact all the forensic DNA analyses are provided, and the great mass of forensic DNA expert opinions are prepared by the NERC, since they are the only institution, that meet the other criteria that are required to analyze forensic DNA (Pádár, Kovács & Kozma, 2020). Namely, Decree 12/2016 (V.4.) of the Ministry of Interior demands accreditation of the DNA laboratory according to the ISO 17025 standard, and the institution's regular participation on proficiency test developed by the European Network of Forensic Science Institutes (ENFSI). Even if the accreditation can be achieved, and proficiency tests developed by the ENFSI Expert Working Groups are also open to non-ENFSI members, the last few years have proved that for medical schools it is not worthwhile to provide these conditions and strict additional specifications, both for personal and material reasons. Institutes of legal medicine of medical schools chose not to apply for accreditation or not to extend their accredited status, since they have not received enough assignments from the authorities. It is obvious for them that the huge costs would not be reimbursed, since the investigating authorities, prosecutors and courts will insist on appointing the NERC if they will need forensic DNA expert opinion. Therefore, the law names the institutes of legal medicine as eligible to provide forensic DNA examinations in vain. In fact, assignors' tendency to avoid them caused a situation where the law turns it into empty words. Consequently, the role of institutes of legal medicine is limited to those parts of the forensic DNA expertise, that do not include laboratory work (for instance interpretation of peak height in profiles, pointing out alternative interpretation of mix-DNA (Pádár & Kovács, 2015)).

Now, let us examine the four possible ways how the DNA expert can effectively help the defense.

#### *Detection of human errors during the collection of samples and laboratory work*

Owing to the fact that DNA evidence is more sensitive than other types of evidence, law enforcement personnel should be especially aware of their actions at the crime scene to prevent inadvertent contamination of evidence (Gárdonyi, 2019). Maintaining the chain of custody is vital for any type of evidence. Another critical point is documentation, that is essential to sustain the integrity of the chain of custody (Herke, Kovács & Gárdonyi, 2020). The institute where the laboratory tests are made, should follow different obligatory guidelines, avoid contamination and shall prepare its test documentation in such a way that all elements of the laboratory activity and the results of the laboratory activity

can be retrieved and verified. The laboratory must keep a record of each test, recording all notes, records, worksheets, photographs, spectra, forms, tables and other (special) data or comments on which the laboratory communicates its findings and supports its conclusions. The laboratory must keep the whole documentation and store it in a retrievable form (ENFSI, 2010). All the documents, including records about collecting, storing and testing can be given to another expert, who can review them and to point out the errors and malpractice. This paper argues that all aspects of DNA testing be fully documented is most valuable when this documentation is discoverable in advance of trial, and it is also available for the defense.

Although generally quite reliable, DNA tests are not now and have never been infallible. Claims that the tests themselves are error-free have contributed to the rhetoric of infallibility that has surrounded DNA testing (Aronson, 2007). These claims are misleading, because humans are necessarily involved in conducting DNA tests. Another expert involved into the case can explain the lack of precision or a potential error of the new or improved methods. The question is, whether this ‘another’ expert could be a contracted expert?

Overall, two facts must be considered when examining the possibility of the defense to employ a DNA expert in Hungary. First, the NERC and institutes of legal medicine at medical schools are exclusively authorized to submit forensic DNA expert reports, but currently only the NERC has the right to perform the laboratory work, as mentioned earlier. Second, every expert has an obligation to refuse the inquiry from the defense to prepare a contracted expert opinion if it interferes with the performance of their obligations received from the authority, and all experts are prohibited from getting into a conflict of interest. Obviously, if there is only one institution in the country that is actually empowered for entire forensic DNA examination including laboratory work, this institution does not bring itself in a position which would later make it impossible for them to work as an assigned expert for the state authorities. And accepting a request from the defense to prepare contracted expert opinion evidently is such a position. For institutes of legal medicine, who can hypothetically also act as a contracted expert, the biggest obstacle to reanalyze data provided by NERC laboratory is the fact, that the full, detailed documentation of the forensic DNA analysis is not attached to the expert opinion and is not available for the parties. Therefore, factually there is no room for contracted expert opinion in the field of forensic genetics. The only chance for the defense in case of faulty expert opinion is that doubt arises in the authority, and it appoints another expert, who can study the full documentation and point out the mistakes (clearly, without laboratory test).

### *Challenging the interpretation of DNA-analysis*

If legal and judicial personnel are not fully trained how to interpret forensic DNA evidence, it can result in false leads and miscarriages of justice. Limited quantities of DNA, degradation of the sample, or the presence of inhibitors (contaminants) can make it impossible to determine the genotype at every locus. Because partial profiles contain fewer genetic markers (alleles) than complete profiles, they are more likely to match someone by chance (Thomson, 2008). Interpretation of DNA mixtures can be challenging under the best of circumstances but is particularly difficult when the quantity of DNA is limited (Thomson, 2008). Peter Gill, one of the world's leaders in forensic science, once said 'If you show 10 colleagues a mixture, you will probably end up with 10 different answers' (Murphy, 2015). In addition, forensic genetic laboratories perform a large amount of STR analyses of the Y chromosome, in particular to analyze the male part of complex DNA mixtures. However, the statistical interpretation of evidence retrieved from Y-STR haplotypes is challenging. Overall, we must not forget, subjectivity is involved in DNA testing. These factors can lead to false incrimination. Nevertheless, one expert can challenge the match or/and the statistical assumptions of another expert. An expert can also perform an independent statistical analysis and present the authorities lower probability estimates (Bennett, 1995). Also, an expert can explain statistical evidence to the authorities in a different way, demonstrating the uncertainty involved likelihood ratios as well the limits of DNA technology (Devlin, 1998). Second expert can offer different – maybe correct – interpretation of the data. But, for the same reason as in the previous case, the current legal environment does not allow the defense to use a forensic expert on DNA contracted.

### *Conducting an independent DNA test*

The ability to preserve biological stains is important in preserving the integrity of forensic evidence. Stabilization of intact biological evidence in cells and the DNA extracts from them is particularly important since testing is generally not performed immediately following collection. Furthermore, retesting of stored DNA samples may be needed in casework for testing, confirmation of results, and to accommodate future testing with new technologies. To be able to safely store the samples, testing laboratories are obliged to be equipped at least with a sample storage capacity of at least 100 liters, refrigerated to at least +4 ° C minimum three times, at least 50 liters to be refrigerated to -20 ° C minimum three times and at least 400 liters to be refrigerated to -70 ° C, all these refrigerators

with uninterrupted operation. Testing laboratories should have regulations for the handling and preservation of samples. In its 1996 report, the US National Research Council (NRC) recommended that any additional tests should be performed independently of the first by personnel not involved in the first test and preferably in a different laboratory (URL3). The 1992 NRC report stated that *'all data and laboratory records generated by analysis of DNA samples should be made freely available to all parties,'* and it explained that *'all relevant information can include original materials, data sheets, software protocols, and information about unpublished databanks'* (URL4). From a professional point of view, the validity of this recommendation is also undisputable in Europe. However, as there is only one laboratory that meets the criteria for forensic DNA testing in Hungary, the personnel providing the control test can be different from those who have run the original test, but the laboratory cannot. This is the biggest barrier for the defense in proving someone's innocence if wrongful conviction occurs. Defense has neither the right nor the possibility to access the collected samples. After all, the defense is in a vulnerable position. After the case is closed, there is no possibility for them to obtain a forensic DNA expert opinion, the defense does not have the right to order additional analysis. Basically, in such a situation it is only the prosecutor, who can order or request a court to obtain a new DNA test if there is a suspicion that the convicted person was innocent.

### *Offering a different explanation of hits and matches*

One cause of false DNA matches is cross-contamination of samples. Accidental transfer of cellular material or DNA from one sample to another is a common problem in laboratories and it can lead to false reports of a DNA match between samples that originated from different people (Champod, 2008). Several legislation and protocols exist to prevent contamination, but it is impossible to completely avoid this phenomenon. In many cases, a control expert may notice an erroneous assessment.

Another occurrence is DNA transfer mentioned above. DNA transfer should be a concern for forensic DNA analysts because

- it could falsely link someone to a crime;
- it could introduce extraneous DNA, or foreign DNA into a forensic sample; and
- it could lead analysts and other medicolegal professionals to falsely conclude that DNA left on an object is a result of direct contact (Cale et al., 2016).

Because many lawyers may lack awareness of the problem of transfer, experts should flag the issue in their reports whenever the testing process indicates that transfer may explain the findings. Expert should alert the authorities in every such situations (Murphy, 2015).

If there is an expert involved in a criminal case who explains how the defendant's DNA could get into the crime scene on other physical evidence, another expert can point out that DNA from individuals who have nothing to do with the crime might be present at a crime scene. New experts can also clarify that DNA that is present in a place changes rapidly as people and objects interact within it. Therefore, experts can help the court to correctly understand the relevancy of DNA found at particular places and help to make the right conclusions derived from the obtained information. However, due to the current Hungarian legislation, for the defense it is not possible to employ an expert who is able to offer a different explanation of hits and matches.

## Conclusion

As can be inferred from the review, in general it is quite limited, as to how the defense can challenge the expert opinion by employing an expert himself. The study has also discussed, how forensic DNA can prevent or reveal wrongful conviction. This paper argues, that to harness the true strength of a DNA expert opinion to prevent wrongful convictions or to bring attention to injustice, there is a need for regulation that

- allows the involvement of a DNA expert in criminal procedure at every stage, including after the case is closed (so to make possible a re-trial based on the expert report), and
- gives the opportunity to the defendant to dispute the expert opinion, and when needed, to present an expert opinion that questions the appropriateness of the state-appointed expert report.

Also, the paper suggests that since the process of preparing and testing DNA samples is prone to laboratory error, and the interpretation of the results of analysis is a subjective activity, we cannot deny the possibility of contamination or human error in the analysis or interpretation. It is essential to clarify all the sources of legal and scientific controversy, that criminal justice should understand and consider when deciding about conviction. The study has shown, that employing another expert – e.g., an expert contracted by the defense – has the potential to assist the court to make a correct decision about the guilty.

An additional finding is that the limitation to submit a contracted expert opinion – especially forensic DNA expert opinion, that is best known for its potential to explore wrongful identification of the convicted – after the verdict makes it impossible to introduce initiatives in Hungary such as the Innocent Project.

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## Online links in the article

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URL1: *NAS: Strengthening Forensic Science in the United States: A Path Forward*. <https://www.ojp.gov/pdffiles1/nij/grants/228091.pdf>

URL2: *NIST: Scientific Foundation Review: DNA Mixture Interpretation*. <https://www.nist.gov/dna-mixture-interpretation-nist-scientific-foundation-review>

URL3: *NRC: The Evaluation of Forensic DNA Evidence*. <https://www.nap.edu/catalog/5141/the-evaluation-of-forensic-dna-evidence>

URL4: *NRC: DNA Technology in Forensic Science*. <https://www.nap.edu/read/5141/chapter/1>

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