CHAPTER 4

DNA Technologies in Criminal Investigation and Courts

Abstract  DNA profiling has been assuming a prominent role in the activities of the criminal justice system. Genetic technologies support criminal investigations, while also being seen as holding a highly valuable potential for producing evidence to be used in courts. This chapter has two main objectives: on the one hand, to describe and explain the ways that DNA technologies can be used in criminal investigation and turned into DNA evidence in criminal proceedings; on the other hand, this chapter aims to systematize the main lines of academic literature within the social sciences which have been developed to study the social implications and transformations of cultures and professional practices arising from the presence of DNA technology in the criminal justice system. Besides, the chapter also pays particular attention to the social nature of the high expectations associated to the “infallibility” of DNA technologies and how the media portrays the use of forensic genetics and further exacerbates such notions.

Keywords  Chain of custody • Criminal investigation • Courts • Infallibility myth • CSI effect
DNA TECHNOLOGIES AND ITS APPLICATION IN CRIMINAL INVESTIGATION

There is now a broad consensus that DNA technologies play a vital role in justice systems in various regions of the world (Hindmarsh & Prainsack, 2010; Kruse, 2016; Lawless, 2016; Lynch, Cole, McNally, & Jordan, 2008; Toom, 2018; Williams & Johnson, 2008). DNA technologies support the collection of information that helps the criminal investigation, and DNA evidence is considered to have great value for judicial procedures.

However, the aura of infallibility associated with DNA technologies generates expectations which are often exaggerated and dissociated from the concrete reality of criminal investigation. It is therefore essential to recognize and identify the potential risks arising from the use of DNA technology, in order to prevent possible errors and threats to civil rights—including upholding the presumption of innocence, genetic privacy and the moral and physical integrity of suspects or persons accused of crimes (McCartney, 2006; Murphy, 2007; Nuffield Council on Bioethics, 2007).

Identification of individuals using DNA profiles is often described as the most important discovery in the world of forensic science since the fingerprint (Lynch et al., 2008) and has even been designated by several authors as the most significant mean of human identification of the modern era. Development of studies on the use of DNA for individual identification depends upon broad zones that exist between the genes that are generally called “non-coding DNA”. These intergenic zones reveal specific chemical sequences that are supposed to be unique to each individual and therefore produce a “genetic fingerprint”. Comparison of different “genetic fingerprints” enables us to observe whether different samples of DNA come from the same individual or different individuals. There is also a biological relationship of descendence between the suppliers of different samples that might be compared. In short, each person’s DNA is unique, except in the case of identical twins.

A new epistemology of forensic identification (Cole, 2009) claims that it is impossible to achieve “perfect” individualization, and therefore, we should speak about probabilities rather than certainties (Kaye, 2009; Saks & Koehler, 2008). Scientific authorities generally argue that absolute individualization is a theoretical goal, but even excluding identical twins, the inclusion of more markers in a DNA profile analysis leads to an increased likelihood of observation of somatic mutations, that is, intra-individual heterogeneity (Amorim, 2002).
Forensic DNA analysis usually involves comparisons between genetic profiles extracted from biological samples collected from a specific site, object or person which is thought to be associated to a crime, in order to determine the likelihood that such samples come from a particular person (e.g., from a suspect, or victim, of a specific crime). Biological substances collected at crime scenes—such as blood, hair, semen, urine, skin, saliva, sweat and tears—all contain DNA. A DNA sample can also be obtained through a mouth smear from an identified person, or by collecting hair samples (including hair roots, since they contain the cells needed for analysis), blood samples (usually achieved nowadays by pricking the finger) or by scraping part of the body to remove a small sample of a person’s skin.

A molecular biological technique, called polymerase chain reaction (PCR) is fundamental for analysing DNA polymorphisms. This technique makes it possible to replicate in vitro and amplify and analyse trace amounts of DNA. Nowadays, this technique is frequently used in the preparation of DNA profiles for criminal identification and makes it possible to pair suspects with blood, hair, saliva or sperm samples. DNA profiles are also often used for forensic civilian identification purposes, in particular for paternity testing and identification of missing persons and human remains (Bier, 2018; Smith, 2017; Toom, 2017).

A technical problem raised by DNA profiles is the fact that contamination with DNA from an outside source can occur, both at the time of collection and in the scientific laboratory. Contamination of the DNA sample is frequent in crime scenes, in old and degraded samples, in corpses and human remains. False identifications are likely to happen when used in partial profiles due to insufficient quantity or degradation of DNA (Murphy, 2007).

In addition to the aforementioned risks, there are ethical issues that derive from the type of information that can be obtained from DNA analysis. While traditional fingerprints only reveal a person’s identity, samples used for DNA profiles may reveal much more information, namely about the individual’s kinship ties, which may be unknown to the individual (Haimes, 2006; Kim, Mammo, Siegel, & Katsanis, 2011). With advances in the knowledge of the human genome, even the so-called non-coding DNA may in the future be associated with sensitive information, such as diseases and behavioural traits (Duster, 2003; Williams & Johnson, 2004a).

The myth of the infallibility of genetic identification can condition the conduct of the police investigation itself and the assessment of evidence in court. Hence, it is desirable to question the reliability and scope of the
DNA evidence and the consideration of the circumstances associated with each case. It is, therefore, necessary to guarantee the principle of taking precautions when using DNA profiling as a means of evidence, since in certain circumstances it may become controversial and maybe a source of abuse and judicial errors (Gill, 2014, 2016; Schiffer & Champod, 2008).

**From the Crime Scene to the Laboratory and the Court**

The presence of DNA technology in the criminal justice system involves multiple professionals and differentiated spaces. Within the framework of the so-called chain of custody, the focus is on the crime scene and its observation to identify and collect biological traces that may subsequently be useful for identifying a perpetrator. Subsequently, the biological traces are analysed in a laboratory context. Finally, scientific reports on the DNA analysis are presented to the persons responsible for judging the case in court.

Social science studies have revealed that, in an initial stage, various controversies arose, associated to doubts about the credibility and robustness of DNA technology that accompanied the start of its practical applications in human identification (Aronson, 2007; Jasanoff, 1995; Lynch & Jasanoff, 1998). However, DNA testing gained a more respected status due to its unparalleled capacity to identify criminal suspects (Lynch et al., 2008; Williams & Johnson, 2008). As Michael Lynch argues, DNA testing is treated “as both the source and object of an extraordinary and even absolute, degree of certainty in criminal law” (Lynch, 2013, p. 60).

Claims for the operational utility and scientific standing of forensic DNA profiling are often made in the context of new concepts and methods designed to improve the quality and effectiveness of police criminal investigation practices (Williams & Johnson, 2008). Therefore, forensic DNA evidence is often viewed as capable of enhancing police practices with some degree of “objectivity” associated with the scientific authority of DNA technologies (Cole & Lynch, 2006; Costa, 2017; Santos, 2014). However, studies with police forces reveal that police professionals consider that DNA testing is subject to various contingencies, which is why it should be seen primarily as a source of intelligence, to be taken into account in criminal investigation in conjunction with other types of leads and evidence (Huey, 2010; Machado & Granja, 2019).
In short, as the anthropologist Corinna Kruse (2016) points out in her study about the Swedish justice system, the views and uses of DNA evidence tend to vary. The different professionals who are involved in investigating crimes and taking decisions on whether suspects should be accused or exonerated, construct different meanings and interpretations regarding the value of forensic genetics. The author illustrates the multiplicity of meanings attributed to DNA testing by different professionals, as follows:

To a crime scene technician, forensic evidence is something that can be produced by traces (…) from a crime scene. To a police investigator, forensic evidence is something that may be able to help him or her to assess a person’s narrative. To a forensic scientist, forensic evidence is a trace that is to be analysed and evaluated (…) To a prosecutor, forensic evidence is something that will help him or her to convince the court of a defendant’s culpability. And to a judge, forensic evidence is something reliable, an anchoring point in their assessment of a case. (Kruse, 2016, pp. 155–156)

Rather than serving as a machine for generating truth, DNA evidence relates to the expectations, epistemic cultures (Knorr-Cetina, 1999) and objectives of each social and professional group. There is no uniform and absolute perception of what DNA technologies can achieve in terms of criminal investigation: the expectations of a criminal investigator are distinct from the convictions of a scientist or from that which is expected from judges, lawyers, jurors or even from convicts. The presence of DNA technology also brings different traditions, cultures, languages and procedures into interaction: it immediately places into dialogue—and tension—science and law (Edmond, 2001; Jasanoff, 2006). While science aims to convey “neutral” and “objective” knowledge, the intrinsic mission of the legal system is to try to establish the “truth of facts” based on scientific evidence and decide on the guilt or innocence of a person accused of committing a crime. In short, a DNA profile is subject to a transformative and contingent process that involves several actors, practices and organizational structures. To achieve the status as credible and robust, DNA evidence is subject to a series of events that highlight technical-scientific, legal and bureaucratic procedures, which sociologist Michael Lynch and his colleagues (Lynch et al., 2008) have termed “administrative objectivity”.

THE CSI EFFECT AND THE ASSOCIATED RISKS

Criminal investigation using the potential of forensic genetics has attracted media attention, fuelling a phenomenon that many people call the “CSI effect”. Television representations of criminal investigation focus on technology: the true heroes of police series are no longer detectives but instead forensic identification technologies (Kruse, 2010; Machado & Prainsack, 2012). DNA evidence assumes a particularly important role in this regard since it symbolizes an ideology in which machines are more reliable and “safer” than human action and knowledge.

Although there is no consensus as to whether or not there is a “CSI effect”, and the exact nature of this phenomenon (see Ley, Jankowski, & Brewer, 2010), it is generally associated with the idea that judges and juries allegedly attribute more weight to evidence obtained through the application of molecular genetic techniques than to other types of evidence. Police stories inspired by DNA technology use cultural images that reflect a dominant idea, which is taken as being accurate and absolute, in relation to the work of researchers and the decisive power of forensic identification techniques—in particular, the perception that DNA evidence offers “infallible evidence”. This set of ideas is propagated not only by television crime drama that focuses on the use of forensic science but also by journalists, lawyers and other actors in the justice system, such as judges, public prosecutors and eventually the police officers themselves.

Academic studies of how the media portray the uses of forensic investigation technologies in criminal investigations, and the effects that this coverage may have on different audiences, have increased in recent years. These studies focus especially in the adversarial judicial system, in which jurors and barristers take centre stage: juries (citizens) can decide whether or not the accused (defendants) are guilty, and it is up to the representatives of the parties involved to argue about the validity and meaning of the evidence admitted to trial. The judge often plays the role of a “passive arbitrator”, responsible for defining the rules of the trial and whether or not the presented evidence may be admitted.

Existing literature on the alleged CSI effect has mainly discussed the way that television series shape audience perceptions of DNA technology, routine crime scene analysis procedures and the steps used to identify criminal offenders, given that audiences are generally distant from the “real world” of criminal investigation and court work. The main focus of these studies has been on the influence of series such as CSI on the
respective viewers (Brewer & Ley, 2010; Schweitzer & Saks, 2007), on
jurors—ordinary citizens summoned by courts to evaluate criminal cases
that may be complex and may involve DNA evidence—and also on judges
and police investigators themselves (Cole & Dioso-Villa, 2007; Durnal,
2010; Huey, 2010; Shelton, Kim, & Barak, 2006).

There is also a study group focusing on how a specific social group,
individuals serving prison sentences, views media messages about DNA
technology. According to existing studies (Machado & Prainsack, 2012;
Machado, Santos, & Silva, 2011; Prainsack & Kitzberger, 2009), prison-
ers tend to believe that DNA evidence has almost absolute power in terms
of identification, based on the idea that the genetic profile is a technology
with a probative and criminal identification capability which is far superior
to fingerprints. However, the infallibility of DNA technology is not con-
sidered to be absolute by these inmates: they accentuate the possibility of
human error and harbour strong suspicions of police officers or malicious
individuals who may deliberately “plant” biological traces in crime scenes
to incriminate them. They have also stated that they fear that the authori-
ties will lie about the existence of DNA evidence to obtain confessions
from criminal suspects (Machado et al., 2011).

Another aspect to be noted concerning the consequences that the TV
series has on the professionals of the justice system is the concern har-
boured by the community of forensic scientists in relation to the alleged
lack of public literacy. The CSI effect, together with a lack of literacy on
the probabilistic framework involved in the interpretation of DNA evi-
dence, is considered by many forensic geneticists to be the major obstacle
in their task of communicating the results of DNA analysis to members of
the criminal justice system (Amorim, 2012; Amorim et al., 2016). A recent
study on the subject, based on the social representations of members of
the forensic genetics community in Europe, highlights the scientists’ con-
cerns about how the professionals of the justice system and members of
the public attribute an excessively “enthusiastic” and “optimistic” value in
relation to DNA’s capacity as evidence in court cases (Amelung, Granja, &
Machado, 2019). In response to these challenges, there are a few strate-
gies for addressing such risk communication. Some examples include pro-
viding concrete models for good practice for evaluative expert reporting
and suggesting standards for evaluative reporting within professional net-
works, such as the European Network of Forensic Science Institutes
(ENFSI) (Biedermann, Champod, & Willis, 2017).
CONCLUDING REMARKS

The risk associated with the use of DNA technologies in the criminal justice system most commonly identified in the literature, in the fields of forensic genetics and the social sciences, regards the myth of the infallibility of genetic identification. Academic research reveals how notions related to the alleged infallibility of DNA technologies can condition the conduct of the police investigation itself, and how evidence is appraised in court. To this effect, it is desirable to question the framework of DNA evidence and consider the circumstances of each specific case. One possible way is to consider that the DNA profile should only be used as a means of backing up other types of evidence, and to safeguard the principle of equal access to evidence, defence and prosecution, as already occurs in most justice systems.

Another risk arising from the use of DNA technology, which should not be dissociated from the myth of its infallibility, concerns the risk of stigmatization arising from social inequalities, which are reproduced as soon as police forces decide to collect a biological sample of certain individuals to the detriment of others. The literature on sociology and criminology has systematically referred to the way that police practices primarily target individuals and communities who are considered to pose risks. This risk of suspicion is directed towards identification and subsequent collection of data (DNA profile and other biometric data) from the most deprived social groups and individuals belonging to so-called ethnic minorities (Chow-White & Duster, 2011; Cole & Lynch, 2006; Duster, 2006; Skinner, 2013; Williams & Johnson, 2004b).

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