DNA evidence in the court room

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The DNA revolution of the criminal justice systems began in 1986 when a DNA fingerprinting technique was developed by Professor Alec Jeffreys (now Sir Alec), and used to solve the infamous Enderby murder case. Since then, DNA evidence has had a major impact on criminal justice systems world wide. It helped not only to prove guilt but what is even more importantly exonerate innocent people who were wrongfully convicted for crimes they did not committed. Forensic DNA analysis is now a routine police tool in fighting crime as it allows unambiguous identification of the criminal by traces of biological material left at the crime scene and also acquit innocent suspects based on DNA evidence.

DNA evidence is circumstantial evidence which assists in identification of the accused of the offence he is tried for. In cases when no direct evidence exists, the prosecution will have to rely on various circumstantial evidence, DNA evidence being one of them, to prove the guilt of the defendant. Each type of circumstantial evidence will put the accused into a diminishing cohort of people who potentially could have committed the crime. The probative value of DNA evidence is very high. If a match between the crime scene and the defendant is obtained it may be of sufficient strength to narrow down the group of potential perpetrators down to several people and even to one person.

DNA evidence and interpretation of forensic DNA results is exclusively the domain of a DNA expert. Obtaining DNA evidence and its interpretation is a scientific discipline in its own right laying on a cross-section of human genetics, molecular biology and statistics. It is vital for a legal team to have a DNA expert who can read through scientific reports provided by the prosecution, interpret them for the leader of the defence and other team members as well as identify possible flaws in the reports and points to mount a successful challenge. It is not unusual to have several experts representing various disciplines to be included in a defence team.

Forensic DNA analysis is exclusion and not inclusion science. It is possible with 100% probability to exclude someone from being a DNA contributor to a sample recovered from the scene of crime however it is impossible to say with the same certainty that it was defendant's DNA which was found in the crime scene. Even if a complete match is obtained there is a small probability that it is not the defendant but someone else who left his DNA. Despite the wide spread belief among criminal lawyers and barristers, DNA evidence adduced at a trial is not an assailable proof of guilt, a DNA match between a suspect and a crime scene, even if it is a complete match should not automatically guarantee a conviction. It is important that the jury is made explicitly aware of the fact that on its own the evidential value of DNA evidence is not enough to convict the defendant of a particular crime, that the weight of DNA evidence depends on the circumstances of the case and that it must always be assessed only in conjunction with other pieces of evidence. Even when a strong match between a defendant and a crime scene sample is claimed by the prosecution, non-DNA evidence may be pointing to someone else as the real perpetrator of the crime. This "other" evidence can decrease the weight of DNA evidence and increase the chances of successful defence.

DNA is a means of identification and as any other means of identification it is prone to errors, uncertainties and conflicting interpretations. DNA analysis can be compromised by a large number of factors, like environment, contamination, bad laboratory practice and human error to name only a few and the results obtained are subject to incorrect interpretation. Even correctly obtained and analysed DNA results are ambiguous and often open to several opposing interpretations. This means that however high is the cogency of DNA evidence without other evidence it would be insufficient to prove the guilt of the accused.

Understanding potential pitfalls of DNA analysis and data interpretation and how they affect the evidence are important for a lawyer in determining how much probative value has the DNA evidence adduced by the prosecution. Obviously, a lawyer cannot be a specialist in all of these areas or even hardly in one of them however, the understanding of DNA evidence and its advantages and disadvantages is paramount for successfully dealing with it in the court room. In this paper I give a short overview of how DNA evidence is obtained and outline possible ways to successfully challenge it in the court room.

Of all criminal cases when DNA is used as evidence two out of three involve sexual assault. The rest are cases dealing with burglary, murder and other types of violent crime. Annually more than 20,000 forensic DNA tests are performed in the UK alone. The UK's National Criminal DNA Database (NDNAD) currently contains more than 2,5 mln samples from suspected individuals and convicted criminals as well as in excess of 250,000 crime scene samples. Every week more than 300 crime scene samples are matched to the suspect and convicted criminal's database.

The most common samples collected at crime scenes are blood, semen and saliva although virtually any biological material or objects which might be handled by the victim or the perpetrator can be DNA tested. Items of clothing, furniture and other items which may have traces of DNA are now routinely used for obtaining DNA evidence. Modern technology is so sensitive that it allows identification of a person by analysing DNA collected from a fingerprint left on the surface of an object or from a single hair left at a crime scene.

The method of choice of forensic DNA analysis is genotyping using Simple Tandem Repeats (STR) markers. These are short identical segments of DNA aligned head to tail in a repeating fashion. STRs are randomly scattered throughout the genome and have a repeat unit of only 1-7 bases long repeated 5-100 times. This is a very polymorphic marker system, with multiple alleles for a single microsatellite locus. Current methods of STR analysis are based on the process, called Polymerase Chain Reaction (PCR). The PCR is a widely used technique for the selective amplification of DNA markers of interest. It is a highly specific and easily automated technique. PCR can amplify a desired DNA fragment hundreds of millions of times in a matter of hours which makes it an indispensable tool for

cases when the amount of biological material is excessively small (e.g. droplet of blood, a single hair strand etc.) or where rapid and high throughput screening is required.

When a crime scene sample or a sample from a suspect is analysed, a DNA profile is produced which is a digitalised representation of an individual's genotype with respect to the DNA markers tested. In the UK an 11 marker system, called SGM Plus is used for DNA profiling. Ten markers give information on individual's genotype while one marker tells whether someone whose DNA is analysed is male or female.

All crime scene DNA profiles together with those of all suspects and arrestees for any recordable offence are deposited into the NDNAD. UK Police use the NDNAD as an investigative tool to help solving a wide range of crimes including murder, rape, sexual assault, robbery, terrorism, burglary and arson and have almost doubled their clearance rate for volume crimes such as house burglary, and motor vehicle offences. As each new subject sample profile is added to the database it is checked against all contained crime scene sample. When a new crime scene sample profile is added it is checked against DNA profiles of all suspected individuals as well as against other crime scene sample records.

After successful conviction, crime scene samples are currently removed from the database in order to prevent repeat matches being reported to the police. Once a crime scene profile is removed from the NDNAD it is not then available for further routine comparison with a profile obtained from any other crime scene or a suspect. This is very controversial as it assumes no miscarriage of justice ever happening in these cases and precludes defence from re-examination of these cases if new evidence or suspect came to light later on.

Since their introduction into forensic science, DNA typing methods have been strenuously attacked in court. There are various pitfalls which accompany the way DNA evidence is obtained or/and interpreted which can be used to develop a successful defence strategy. They can be built around two major points - evidence admissibility and evidence interpretation issues as well as some case-specific issues.

The admissibility issues are related to the origin of DNA samples, transfer of DNA samples from the crime scene to the forensic laboratory (chain-of-custody) and the laboratory practice and technology, used for analysing the samples. General rules of evidence admissibility (for example low probative value) also apply when it is decided whether or not to admit particular DNA evidence.

Chain-of-custody issues are of paramount importance for DNA evidence admission. Biological material at the crime scene is collected by a forensic team and then passes through custodies of several police forces or couriers until it eventually reaches the destination laboratory which can be hundreds of miles away. It is important to be sure that the samples analysed are those that were collected at the scene of crime. The process of transporting the samples from the crime scene to the laboratory has to be meticulously documented and under no circumstances whatsoever should evidence be left unattended. It is important that defence scrutinise the way biological evidence was collected and transported – in cases of any major mistakes admissibility of the DNA evidence may be successfully challenged.