



So DNA is objective?

DNA is widely perceived as objective scientific evidence in criminal trials and thereby being perceived by jurors are compelling evidence. If only!

Of course, it may depend on your definition of 'objective'. It should mean, *independent of the observer*, meaning that any two (reasonable) people would come to the same conclusion about the same observation. An objective measure would be incapable of any other sensible result.

Does DNA evidence fit this definition?

DNA profiling produces amazing numbers; '1 in a billion that the DNA came from another unrelated person'. It does this by multiplying the chance of finding each piece of DNA at 10 areas (in the UK; 13 or 15 in the USA; it depends on which kit you are using) at which a person can have up to two DNA profiles begin as a series of peaks on a graph, giving a total of 20 possible options across the 10 areas. By knowing the chances of finding any particular combination (of which there are more than trillions) across the entire profile we estimate the significance of the finding. Of course, *the statistic is only meaningful if each piece of DNA has been properly identified*.

A DNA profile starts as a series of peaks on a graph. The peak heights represent the approximate amount of DNA in the sample. These heights are measured in rfu's (relative fluorescence units). Now you may think that above a specified height peaks would be regarded as true and below that height as unreliable and therefore removed from consideration. The level where the line is drawn is called the peak height threshold. Unfortunately, the choice of the peak height threshold is frequently left to the eye of the beholder.

In many labs, although there is a 'guideline' level, there is frequently a discretion to move the 'there/not there' decision down. This introduces a choice for the analyst. And one analyst may decide to move the threshold down when another may not. Many labs require 'peer review' where another analyst is required to check and agree the result. Why do that if the process is objective?

Worse, if the two analysts don't agree many labs then say that it should go to a 'more experienced' analyst to provide the final decision. How does



experience help if you never know the true results when you are dealing with crime stains?

Things become even more awkward when the sample may contain a mixture. We have had at least one case where the profile produced completely different conclusions depending on where the line was drawn. As the peak height threshold is lowered, the profile changed from a poor match to the suspect, to a better match to the suspect, to a match to an entirely different person, to a mixture that the suspect may have been a contributor to. The Crown scientists drew the line... well, I will let you guess. The Crown dropped the case when we produced our report.

On the same theme, we have many other cases where a mixture from several people is discovered as the crime stain. Normally, given that no DNA profile is unique, statistics are expected to enable the Court to assess the weight of the evidence. That is the scientific way of doing things.

We are now seeing cases where the profiles from mixtures are simply not clear enough to enable any reliable conclusion as to the profiles of the potential contributors. That no longer provides a problem for some. They simply pick the alleles from a suspect that are present in the mixture and decide for themselves how strong the evidence is that the profile matches the suspect. For some, this matching the suspect to the profile rather than the other way around is a potentially flawed and misleading approach. We have had several cases where we have had DNA evidence that does not include statistics be ruled inadmissible.

Thing become even more complicated and worrisome in the area of Low Copy Number or Low Template DNA (LTDNA). This technique is prone to spurious peaks and absent peaks. Peaks are supposed to be reliable only if they are duplicated in two or more runs, although even that claim is contentious. In several cases it now seems that unconfirmed peaks are having significant effects upon the interpretation of profiles. The choice as to whether they are influential is of course down to the examiner. The danger of this freedom of choice is that the analyst can choose to interpret a sample as a single source profile which could be highly incriminating against an



individual, or change it to a mixture that may be used to explain the presence of DNA that doesn't fit the suspect.

The latest twist is the development of so-called 'composite' profiles. Poor profiles? Only a few areas typed? No problem. Just toss the ones you need together and produce a new, composite profile even if they were not produced from the same sample! The choice of profiles to combine, and the meaning of the result, are all subject to the choice of the analyst.

So for anyone who believes that all DNA profiling is objective, especially from crime stains, just consider the number of choices that the analyst can make and the difference these choices make to the interpretation and evaluation of the profile. Objectivity in DNA analysis, especially at low levels of DNA, is a myth. There are solutions, but the forensic science community, funded mostly as they are by law enforcement agencies, are perhaps loathe to sacrifice the discretionary choice that enable them to turn poor results into 'good' evidence.

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