IN THE HIGH COURT OF AUSTRALIA
SYDNEY REGISTRY   No. S315 of 2011
BETWEEN:

HIGH COURT OF AUSTRA~~~YUSUF AYTUGRUL

FILED   Appellant

AND

28 OCT 2011

THE QUEEN

THE REGISTRY SYDNEY   Respondent

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APPELLANT'S REPLY

It is certified that this submission is in a form suitable for publication on the internet.

1. The submissions of the respondent demonstrate that there is much common ground between the parties. The respondent accepts that the presentation of DNA evidence may give rise to numbers "*so 'impressively persuasive' in themselves that they sway the jury into giving the match ratio undue weight with the risk that the jury may surrender the*
20   *evaluative task to the seemingly overwhelming impact of the computation*" (6.1). The respondent also accepts that statistical evidence may be explained in different formulations and that it may be desirable "*to avoid formulations which invite fallacious reasoning or possible misunderstanding*" (6.4). In this respect, the respondent's submissions do not appear to adopt the approach of Simpson J, who stated that s 135 and s 137 are "*concerned with the content of the evidence, and not the manner in which it is expressed*" (at [176]). The respondent's submissions seem to accept that, in certain cases, "*particular formulations [of statistical evidence] may be excluded to avoid the risk of unfair prejudice*" (6.6).

30   2. The key point at issue relates to the existence of a risk of unfair prejudice arising from the percentage exclusion presentation in the circumstances of the present case. The respondent's submissions appear to suggest, in effect, that the DNA evidence was not powerful or significant enough in the circumstances of the case to attract the risk of prejudice identified in cases such as *R v GK* (2001) 53 NSWLR 317, *R v JCG* (2001) 127 A Crim R 493 and *R v Doheny and Adams* [1997] 1 Cr App R 369. The respondent's submissions focus on three features of the present case that are said to obviate the risk of undue prejudice arising from the 99.9% exclusion presentation:

- the low random probability match ratios, ie the frequency estimates ranging from
40   1 in 50 to 1 in 1600;

- the explanation given by the scientific experts regarding the limitations of the mitochrondrial DNA evidence and the "lack of precision" with which the evidence was presented; and

- the factual matrix of the case which suggests that the "suspect population was relatively small".

Low Random Match Probabilities

3. The respondent's submissions outline much of the literature and case law which acknowledge the risks associated with statistical presentation of DNA evidence. The submissions do not suggest that the percentages in question in *GK* and *Galli* were improperly excluded or that those cases were incorrectly decided. The submissions acknowledge the "well accepted" proposition that "stark" mathematical calculations carry such a risk that the evidence may need to be excluded - or at the least balanced with jury instructions about the qualifications and limitations of the evidence.

4. Instead the respondent draws a distinction between the present case and the evidence in *GK* where the random match probability, according to the submissions of the respondent, "were of the order of 500 million to one" and the "relative chance of paternity" was expressed as 99.9993% (6.7). The distinction between the figures of 99.9993% and 99.9995% used in *GK* and the 99.9% used in the present case (or 99.99% as it was inadvertently expressed) is a fine one. Both calculations could fairly be described as "extraordinarily close to 100%" (Sully J in *GK* at 341[99]). However, the respondent rejects the notion that percentage figures inherently have a greater subliminal effect and suggests that the risk in *GK* was the potentially overwhelming cumulative effect of the high match ratio and the percentage figure.

5. The respondent states that "in the present case, the random probability match ratios were quite low, as low as 1 in 50, and posed no risk that the jury might be misled into thinking that the ratios negated any possibility of matches other than the appellant". It is the respondent's submission that the risk of undue influence from very high ratios arises "not from the fact that the figures are expressed as percentages but because such overwhelmingly high numbers have considerable impact in themselves"(6.8). While the respondent accepts that "as the figures approach 100% the risk that the jury may reason fallaciously to guilt increases", it is suggested that is "largely because the figures themselves become more compelling rather than the form in which they are expressed" (6.15).

6. The reference to "500 million to one" in the respondent submissions at 6.7 is misleading. In *GK*, experts called by the prosecution gave statistical estimates of paternity in two forms – a "paternity index" expressed as a likelihood ratio and a "relative chance of paternity" expressed as a percentage figure. One witness, Mr Goetz, expressed the paternity index as 220,000 to one, the other witness Dr Gunn, provided a figure of 147,005 to one (at 320[12] – [13]). The relative chance of paternity was estimated at 99.9995% and 99.9993% respectively. It was these percentages that were regarded by the Court of Criminal Appeal as creating a risk of unfairness (Sully J at 337[88], 338[91], 341[99]). As Professor Ligertwood has observed, the frequency

estimate of "220,000 to one" was low enough for the defence to postulate the existence of other fathers:

> [T]he expression of this ratio in percentage terms of over 99% was what worried the court. This percentage fudges the possibility of other fathers and sets in train a process of reasoning that can easily slide into "the prosecutor's fallacy"[1].

7. Empirical literature supports the connection between the prosecutor's fallacy and percentage expressions[2]. The use of decimals in the present case also appeared to create a risk of misleading or confusing the jury as the decimal figure was repeatedly expressed inaccurately during the evidence and during the summing up (see SU 29 and 31; McClellan CJ at CL at [58] –[62]).

8. The contention that low match ratios balance or ameliorate the risks posed by percentage exclusion evidence is not supported by the empirical literature. The study conducted by Professor Koehler, noted in the respondent's submissions at (6.29-6.31), used ratios analogous to the present case, ie 1 in 1,000. The study revealed that mock jurors found evidence with a fractional numerator (ie "0.1 out of one hundred people would be expected to match the profile") considerably more persuasive than the identical formulation in frequency terms ("1 out of one thousand"). The study appears to confirm the thesis that fractional numerators made it harder for jurors to imagine the possibility of other people matching ("exemplar cuing"). The mock jurors in the study even found evidence expressed as ".01 out of hundred people" more persuasive than the objectively stronger presentation of "one in 100,000" or "2 in 200,000. In fact, that study suggests that the risks of undue weight attaching to percentage or fractional figures <u>decreases</u> as match odds get higher[3]. There is a sound explanation for this result. The presentation of statistical evidence is most significant when there is a realistic prospect that the presentation will enable a juror to imagine instances of other matches. When match odds are low, there are expressions that will allow a juror to conceive of those matches, particularly frequency estimates like "1 in 1,000". The empirical studies suggest that the use of percentage figures detracts attention from the possibility of other matches – even when percentage figures are used in conjunction with frequency ratios.[4]

9. The risk that percentage figures detract attention from jurors considering the possibility of other matches was identified in *GK* and *JCG*. That risk was considered sufficient to exclude the evidence even when a ratio was also going to be presented to the jury (see Sully J in *GK* at 341[99]. The risk was considered even more significant in *JCG* because the match odds were low (see Spigelman CJ in *JCG* at 507[72]). The

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[1] A Ligertwood "Avoiding Bayes in DNA cases" (2003) 77 ALJ 317 at 321.
[2] J Koehler "The Psychology of Numbers in the Courtroom: How to Make DNA-March Statistics seem Impressive or Insufficient" (2001) 74 *Southern California Law Review* 1275, W.C. Thompson and E. L. Schumann "Interpretation of statistical evidence in criminal trials: The prosecutors' fallacy and the defense attorney's fallacy" (1987) *Law & Human Behavior* 11: 167–187.
[3] ibid at 1293-1295
[4] ibid at 1293-1294

percentage figure presents the greatest risk of fallacious reasoning. It is the form of statistical expression most likely to divert jurors from their task of proper consideration of all the evidence in the context of the burden of proof in favour of a mathematical short cut, equating the percentage figure with odds of guilt. It was this concern which attracted the court's attention in *GK* - not the overwhelming cumulative effect of the figures.

10. It is not suggested by the appellant that admissibility should be "in an inverse ratio to persuasiveness". Rather, it is submitted that, in the circumstances of the present case, the incremental probative value of a percentage exclusion figure was minimal and failed to outweigh the real risk of unfair prejudice inherent in the use of the figure.

Explanations provided to the jury about the evidence

11. There is no dispute between the parties that the extent of the prejudicial impact of statistical evidence may depend upon any explanation of the evidence provided to the jury and directions and comments of the trial judge. It is also common ground that some formulations are so potentially prejudicial or misleading that explanation may be insufficient and some evidence may need to be excluded. The respondent asserts that in the present case "the jury was given detailed explanations of the nature of the statistical evidence and its limitations" (6.17). The submissions at 6.17 to 6.27 outline various features of the evidence provided by the three scientific experts which expressed qualifications and caveats in relation to the strength of the evidence. The submissions do not address the limited instructions that were provided to the jury. Most of the instructions in relation to the mitochondrial DNA evidence related to the significance of the "mismatch" between the appellant's profile and the profile detected on the hair. The trial judge did not outline how the statistical estimates were arrived at or repeat any of the evidence which undermined the apparent precision of those estimates. The trial judge did state that the evidence could not establish with certainty that the hair was the appellant's. However, the instructions did not include any caution against the prosecutor's fallacy when evaluating the statistical evidence. The jury did not receive a warning that the question of proof beyond reasonable doubt is not a mathematical exercise or caution against adopting the statistical evidence as an expression of the percentages of guilt. The jury were not given any examples by the trial judge that counteracted the risk that stating "[p]utting it another way, 99.99% of the population could be excluded as possibly having this profile" (SU 29) could undermine or disguise the number of other potential matches. The "football stadium" analogy was not adopted by the trial judge nor did his Honour refer to the number of people in the population who would be expected to share the profile.

12. The complexity of the expert evidence and its attendant limitations increased the importance of the jury being carefully instructed to properly engage with the difficult evidence. The respondent correctly states (at 6.28) that "in the overall context of the statistical evidence, the percentage exclusion ration played a minor part". However, the statistic assumed great prominence in the instructions to the jury. The repeated use of the percentage exclusion expression by the trial judge was no doubt motivated by a desire to

provide assistance to the jury and a clear pathway through complicated technical evidence but it risked providing a beguiling and potentially misleading "short cut".

The "suspect population"

13. The respondent's submissions at 6.43-6.58 repeat features of the prosecution case against the appellant. The connection between that evidence and the expression of the percentage exclusion figure is not readily apparent. While the respondent disputed the appellant's contention in the Court of Criminal Appeal that the verdict of the jury was "unreasonable", it is not contended by the respondent that this is a suitable case for the application of the proviso. The prosecution evidence absent the mitochondrial DNA evidence, while raising suspicion in respect of the appellant, could not prove the applicant's guilt (McClellan CJ at CL at [121]). It cannot be doubted that the possibility that the hair belonged to another person, whether that person left the hair innocently or was connected to the murder, was a critical issue in the trial. That possibility had to be evaluated in the context of the statistical frequency of the profile because forensic testing had eliminated only one person, Mr Tunc. There was no other forensic evidence which supported the hair belonging to the appellant or which connected the profile on the hair to the murder.

14. The respondent's reference to a "suspect population" may be intended to suggest that the probative value of the DNA evidence in the present case was significant, because if the number of potential murderers is low, even a relatively high number of people in the general population who would be expected to share the mito-type found in the hair would not serve to undermine the significance of a match with the appellant. However, any such contention conflates two issues – the probative value of the DNA evidence and the probative value of a particular way of expressing the DNA statistical evidence. It may be accepted that the DNA evidence was a significant part of the prosecution case that increased the probability that the appellant was guilty of the crime charged. However, given the relative importance of the DNA evidence in this case, it was essential that it be presented in a way that minimised the risk of it being given more weight than it actually deserved.

Dated: 2 6 October 2011

SJ Odgers SC
Appellant's Counsel
Ph: 9261 1622
Fax: 9261 4600
Email: odgers@forbeschambers.com.au

K Edwards