

Dear Editor,

We thank the Body Fluid Forum (BFF) for their letter [1] in reply to our review article [2], in particular their acknowledgement of the quality of the review and their willingness to enter into debate on this matter. It is important that issues of this nature regarding the interpretation and evaluation of evidence are debated among scientists, given the high stakes involved when such evidence is presented at court.

The BFF is comprised of those providing forensic science services to the police in the UK and Ireland and are therefore predominately instructed on the behalf of the prosecution. Their collective view regarding the perceived duty to report all the complexities and limitations in issues of DNA transfer, is that, "Shying away from this duty on the grounds that considerations regarding transfer of trace DNA is less known than source level DNA is not acceptable." Firstly, we are not advocating shying away from our duty to the court, but instead insist that the sources of information on which opinions are based, and the uncertainty associated with any probabilities ascribed to those opinions, be transparent and appropriately considered within an interpretation framework. Secondly, our concerns regarding the transfer of trace DNA are not because less is known than about source level DNA, but because of the range of, and sometimes contradictory, results that have been obtained [2], making the provision of reliable datasets on which to base evaluative opinions difficult or impossible.

So-called 'wearer DNA' and material obtained from beneath fingernails are two examples referred to by the BFF as providing, "a reliable dataset for an interpretive approach to issues related to the mode of transfer of DNA evidence in case work". In our review, we considered wearer DNA and cited the only paper based on controlled experimental data available at the time [3], as well as the quote from Rudin and Inman [4] (in a fuller form) that the BFF include in their letter. However, whilst Rudin and Inman state that the habitual wearer tends to be the major source of DNA on a garment, their conclusion is based on those experiments by Stouder et al [3] that, as we discuss in the review, use items of clothing that had only been worn by one wearer on one occasion and so therefore cannot actually inform about the habitual wearer. It is the paper by van Oorschot et al [5] to which the BFF refer, published after our review, that gives the first published data specifically considering the habitual wearer, given that the participants wore bracelets over several days and provided items that they had been worn over much longer periods of time. It is surprising in the context of the history of research on DNA transfer, in which contradictory findings are frequent and the large number of

unknown and sometimes immeasurable influences are acknowledged, that the BFF consider the inclusion of this single additional paper changes the situation to the extent that such evaluative opinions on wearer DNA should now be considered reliable.

Furthermore, it is agreed by all the member laboratories of the BFF that “when sampling areas, such as inside collars and cuffs, the profile is likely to be that of the wearer”. We infer they mean the habitual wearer, but in many cases the issue is the wearer at the time of the crime. This person may not be the habitual wearer, especially when considering items of clothing like coats and jackets. Obviously the study by van Oorschot et al [5] sheds some light on this. However, whilst this additional work contributes to the body of research that exists, referring to a single additional published paper does not form a reliable dataset when considering an evaluative opinion on how DNA came to be on clothing. It is a significant acknowledgement that a published and reliable dataset does not yet exist, given that the Chartered Society of Forensic Sciences awarded their research scholarship in 2015 for a project entitled: “An investigation into the optimal locations to recover ‘wearer DNA’ from clothing” [6].

Our comments here are based on peer-reviewed published research, as was our assertion in the review that DNA quantity and profile quality cannot be used to infer the mode of DNA transfer [2], and we provided the available and published data in the review to demonstrate the derivation of that conclusion. In addition to such published research, the BFF comment that evaluative opinion can also be based on casework experience and unpublished data. The issues associated with using casework experience as a source of opinion have been extensively commented upon elsewhere [7-9]. It is not a valid scientific basis for most opinion and certainly not when the provenance of the items under study is unknown and there has been no systematic scrutiny. It is the opinion of the UK’s Forensic Science Regulator that empirical data is needed to support the evaluation of evidential significance, in particular from structured studies on the transfer and persistence of trace evidence [10], which includes trace DNA.

It is our opinion that the data from such studies should ideally be published in peer-reviewed journals for it to be relied upon in court. We acknowledge that there exists much unpublished research on relevant topics to the evaluation of trace DNA evidence, particularly on the subject of wearer DNA as commented by the BFF. However, there are serious issues with relying upon unpublished data to form evaluative opinions, especially if the data are only disclosed in the witness box and not in advance of a trial, thereby denying any proper consideration by the defence. Whilst it would appear from their

letter that research is shared among the member laboratories of the BFF, if it is unpublished, it remains behind the closed doors of those forensic science providers and is not available to the wider forensic scientific community. This community comprises not just scientists providing services for the police, but also those instructed by the defence and those conducting research in academia. Within casework, it is our experience as scientists instructed by the defence that it is very rare for unpublished data, on which a scientist for the prosecution has based their opinion, to be made available to the defence. Along with issues of resources and restricted access to casefiles [11-13], this raises yet another issue that illustrates the inequality of arms between scientists of the prosecution and the defence. In addition, when research is not published, it is not subjected to the scientific peer review process, which is designed to ensure that only rigorously conducted research giving robust and reproducible results is made available to the scientific community. As such, the quality of unpublished data cannot be scrutinised and verified by members of the scientific community, thereby limiting its value to the courts.

It is because of these issues that we cannot agree that arguments against relying on casework experience and unpublished data have “firmly been expunged” by the rulings in *R v Weller* and *R v Reed & Reed*. These rulings were deliberately not mentioned in our review because:

- a) quite simply, our review was of published scientific studies and their data; furthermore, along with othersⁱ, we do not currently regard courts as a reliable test of scientific principles, and
- b) others have already commented on the scientific deficiencies in those judgements [7, 14, 15].

In fact, in regard to fingernails, the specific topic in *R v Weller* and one of the two areas claimed by the BFF as having reliable data, several scientific authors have addressed the flaws in the judicial reasoning in that case (amongst others, we have published articles specifically discussing those cases [8, 16]). For example, Gill [15] pointed out, “If a logical approach is followed, the strength of the evidence used for conviction was weak,...the observation of the DNA profile on fingernails of Weller has limited relevance since it could be explained by several alternative transfer methods...”(p.46-47). Furthermore, speaking generally, the Forensic Science Regulator has recently acknowledged that a gap exists between approaches that scientists take to interpreting results and the reaction of courts

ⁱ “For a variety of reasons — including the rules governing the admissibility of forensic evidence, the applicable standards governing appellate review of trial court decisions, the limitations of the adversary process, and the common lack of scientific expertise among judges and lawyers who must try to comprehend and evaluate forensic evidence—the legal system is ill-equipped to correct the problems of the forensic science community. In short, judicial review, by itself, is not the answer.” National Academy of Sciences Report 2009

to such methods [10]. The Regulator has made it a high priority that an evaluative interpretation standard be developed and we look forward to the publication of the consultation draft of such guidance in the coming year.

Finally, the BFF believe that “even in the presence of limited data sets and unpublished laboratory data forensic practitioners should where possible, objectively evaluate the available evidence or at a minimum communicate to the courts the scientific reasons why an evaluation was not possible rather than delegating the task to the fact finder who may tilt the value of the evidence in their favour.” We agree that leaving evaluation to the triers of fact is undesirable and an evaluative opinion should be provided where possible, with an objective evaluation based on controlled scientific research being the desired end. We consider that in the current state of research in DNA transfer, the safest and scientifically justifiable approach is to advise the court that it is not possible to provide a scientifically reliable opinion on the route of transfer given the paucity of data and the number of unknown factors involved. We wish that it was not so, but wishful thinking, or a desire to be ‘helpful’ is not enough. However, if unpublished data are to be relied upon, then these should be made available to the defence to allow a proper scientific scrutiny of the basis of any evaluative opinion offered. Likewise, if casework experience is proffered as the source of an evaluative opinion, then it should be clearly explained how such experience has informed the opinion; quoting ‘x years of casework experience’ is simply not sufficient.

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