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Authors' Response

Sir:

We thank Dr. Rowley for her valuable comments regarding the article "Validation studies of an immunochromatographic 1-step test for the forensic identification of human blood". As demonstrated in the paper, whole blood samples from human donors and several primates tested positive for human hemoglobin to a dilution of 1:100 000 when sterile water was used to dilute the samples.

In response to Dr. Rowley's letter, we obtained whole blood from a domestic ferret (*Mustela puterius fero*) by venipuncture and serially diluted the blood to 1:100 000 with sterile water. Indeed, the blood sample tested positive for human hemoglobin using the Hexagon OBTI Test to a dilution of 1:100 000.

Therefore, our statement: "In the species specifity experiments only human and primate blood tested positive with the assay. These data suggest that the assay is primate specific" can now be modified to "in the species specifity experiments only blood from human, primate, and domestic ferret (*Mustela puterius fero*), which shares a common amino acid sequence from residues 67 to 73 of the alpha chain with human, and primate hemoglobin, tested positive with the assay. These data suggest that although the assay tends to be primate specific, positive results also may be obtained from whole blood from the domestic ferret (*Mustela puterius fero*)."

However, in forensic casework, the practical implications of this cross reactivity with ferret blood is minimal, since one can assume that the number of cases where ferret blood may be found at the scene is low and crime scene investigation can determine if a pet ferret was possibly at the scene. Most important, if the blood sample yields a typical human DNA profile (1), we can reasonably deduce that the blood is of human origin. Therefore, this simple test is still an excellent tool for the forensic laboratory, even if its limitations (positive reaction with human blood, as well as primate blood and ferret blood) are considered.

Reference

1. Sparkes R, Kimpton C, Watson S, Oldroyd N, Clayton T, Barnett L, et al. The validation of a 7-locus multiplex STR test for use in forensic casework. Int J Leg Med 1996;109:186–94.

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Commentary on Koons, RD, Buscaglia J. The forensic significance of glass composition and refractive index measurements. J Forensic Sci 1999;44(3):496–503.

Sir:

We wish to congratulate the authors on their work. However, we feel that the very data that they have presented appears to be amenable to the opposite conclusion to the one given by the authors and feel that forensic application of their conclusion may be seriously misleading.

The aims of this paper appear to be to demonstrate that elemental analysis and refractive index together have such good discriminatory power that to attach further statistical analysis to any evidentiary item is pointless. We start by making a general point. The discriminatory power of a technique is interesting per se. However, it cannot be discerned from this paper. Not only is the methodology for developing this number suspect but the discrimination of refractive index and elemental composition is inextricably linked. Of much greater interest would have been the discrimination of elemental analysis conditional on refractive index.

The authors set to prove their point by showing that the range of probabilities of two random pieces of glass sharing "indistinguishable" attributes is in the "very unlikely" range. They present a concept that they call the "information content". We reject this concept as a valid measure of discrimination for the very reasons that the authors give in their own work, and are concerned that the concept is given any credence at all.

In presenting the probability that two pieces of glass from different sources would "match by chance" the authors have answered the pre-data question, which is "What is the probability I would make a mistake if I carried out this matching procedure?" rather than the post-data question, which is "How much does this evidence increase the likelihood that it was the accused who broke it?" It is, of course, the latter in which the court is interested (1,2). Such a question can only be answered by a Bayesian analysis of the evidence and despite the authors' claims to the contrary, database collections of glass samples are the most reliable way we have of assessing the value of such evidence. Furthermore, if we analyze a simple case in the Bayesian framework, it becomes evident that statistics are actually more necessary than in the DNA situation. For example, take a case where a single group of glass has been recovered from a suspect. A small sample of glass has been taken from the crime scene and the evidence has been measured using some analytical method (RI or elemental composition). The likelihood ratio (LR) under consideration is, as in any case,

$$\mathrm{LR} = \frac{\Pr(\mathit{Evidence} \mid \mathit{Contact})}{\Pr(\mathit{Evidence} \mid \overline{\mathit{Contact}})}$$

When the LR is coupled with the jurors' prior odds on *Contact* it yields the posterior odds on *Contact* having seen the evidence. When the LR in this particular case is calculated using the notation of Evett and Buckleton (3) it becomes

$$\mathrm{LR} = T_0 + \frac{T_L P_0}{S_1 P_L} \cdot lr_{cont} \approx \frac{T_L P_0}{S_1 P_L} \cdot lr_{cont}$$

where $\frac{T_L P_0}{S_1 P_L}$ represents expert knowledge about the number of fragments that might been transferred, persisted and were recovered, the number of fragments from a single source, and the number of sources. The quantity lr_{cont}, introduced by Walsh et al. (4) for RI and Curran et al. (5) for elemental information, represents the ratio of "match" strength to the relative rarity of the glass in the population. In a simple two stage approach, where the LR is calculated only if the samples pass some sort of matching criterion, then

$$lr_{cont} \approx \frac{1}{\hat{P}}$$

where $\hat{P}$ is the relative rarity of the glass. This quantity can only be calculated from a database of glass samples. It is clear that in this case the form of lr_{cont} is very similar to the LR for a single contributor stain in a DNA case. With STR loci in DNA analysis there is effectively no measurement error in determining the match, and therefore the numerator of lr_{cont} is 1 in simple cases. However, if