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Volatile Identity Signals in Human Axillary Sweat: The Possible Influence of MHC Class I Genes

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ABSTRACT

Underarm sweat was collected on cotton fabric from 10 donors, 6 of whom were twins. All donors had been tissue typed for class I HLA-A and -B antigens and each pair of twins had the same DNA profile, proving monozygosity. Using equipment and techniques designed to give good chromatographic reproducibility, the sweat volatiles were trapped and analysed by gas chromatography using a flame ionisation detector. When computerised pattern matching was carried out on the profiles of pairs of chromatograms, it was found that all 3 sets of twins were better matched than any of the unrelated people. Preliminary experiments found no evidence that unrelated people with closely matched HLA-A and -B types had well matched volatile profiles but this warrants further investigation.

KEYWORDS

Sweat volatiles; pattern matching; human identity; MHC class I.

INTRODUCTION

The Major Histocompatibility Complex (MHC) is found on the short arm of chromosome 6 in humans. Almost all nucleated cells express class I MHC molecules and in humans these are referred to as Human Leucocyte Antigens (HLA). Ferstl *et al.* (1992) reported that individual body odour could be related to HLA type and several groups working with rodents have shown that urine odours carrying identity signals may be related to the MHC (Brown *et al.*, 1987; Singh *et al.*, 1988; Yamazaki *et al.*, 1990). The aim of the present study was to see to what extent human sweat volatiles were influenced by genetic make-up and, in particular, by the class I HLA genes.

By collecting sequential fractions of volatiles separated by gas chromatography, Sommerville *et al.* (1990a) showed that dogs could distinguish the scent of identical twins using some but not all of the fractions. The fraction where straight chain alkanes 12-14 carbons long eluted

(fraction 2-3) seemed to be indistinguishable in a twin pair. A computerised pattern matching technique (Sommerville *et al.*, 1990b) showed this region of the chromatogram to be rather more similar in identical twins than in unrelated people but it was difficult to obtain adequate chromatographic replication for good pattern matching.

METHODS, RESULTS AND CONCLUSIONS

Ten human donors of known class I HLA tissue type, collected sweat by wearing cleaned cotton squares against their armpits for 8 hours. Four of the donors were two pairs of identical twins whose monozygosity had been confirmed by DNA profiling and the remaining six included one pair of identical twins but the analysts were not told which samples belonged to the twins until the study was completed. A recirculating system (Sommerville *et al.*, 1994a) at 70°C was used to transfer sweat volatiles from the cotton squares into a Tenax trap. Three traps were loaded consecutively from each sample; the first for 2 minutes (about 1000 ml of clean air passed over the sample and through the trap); the second for 3 minutes (c. 1500 ml) and the third for 5 minutes (c. 2500 ml.). The volatiles were desorbed from the trap in a modified GC injector set at 300°C then run through a medium polarity capillary column (BP 10; temperature programme: 35 - 100 C @ 5 °/min.; 100-300 C @ 12°/min.). The trap loading system gave very consistent chromatographic results with a preponderance of high volatiles in the first trap and a preponderance of low volatiles in the third trap. Computerised pattern matching (Sommerville *et al.*, 1994b) was carried out on randomly assorted pairs of chromatograms.

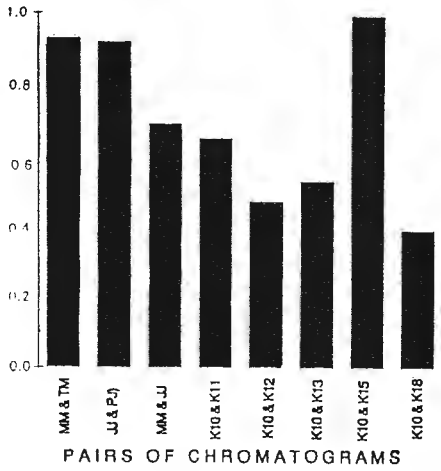

Fig. 1. The profile correlation in the matching programme gave the best match results

A match score of 1 indicates virtually identical chromatograms. The two pairs of twins, MM +TM and JJ+PJ, as well as K10+K15 were found to have higher match scores than MM+JJ or

any other combination with K10. At the end of the analyses, the identical twins in the K set were revealed to be K10 and K15. The HLA tissue typing of the donors was as follows:

UNRELATED			TWINS		
K11	A3,-	B7, 55	K10 K15	A1,2	B8,44
K12	A1,3	B8, 13	J J P J	A11,19	B22,27
K13	A31,32	B14,62	M M T M	A19,31	B15,40
K18	A1, -	B8, -			

Figure 1 shows slightly higher profile matches in the unrelated pairs MM+JJ and K10+K11. The twin members do share a common HLA allele, A19, but K10 and K11 have no A or B alleles in common. K18 and K10 have A1 and B8 in common but their profile match is low.

We are carrying out a new experiment with unrelated donors selected on the basis of having 3 or 4 HLA alleles in common. We are using mass spectrometry to identify the volatiles as well as pattern matching but the preliminary results have failed to show any relationship between class I HLA tissue type and the pattern of sweat volatiles. It may be that the similarity seen in identical twins depends upon other parts of their common genome.

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