Seroanalysis as a means of establishing a child's unknown, putatively alien paternity

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A child either takes after its father or its mother or lies somewhere in between. The same applies to a child's blood group properties, i.e. a child's K value [1] may lie closer to that of the father or that of the mother or somewhere in between (Hummel 1986). If we proceed from defined triplets with a German and an alien father respectively, the lgK values of the children will be scattered symmetrically around those of their parents, provided that the latter are ethnically similar. As the "phenotype distance" between the parents increases there is a shift in the lgK values of the children away from those of the mother towards those of the father. Thus, if a child has an alien father this will be revealed by a blood group analysis: the child's lgK value will be higher than that of its mother (fig. 1).

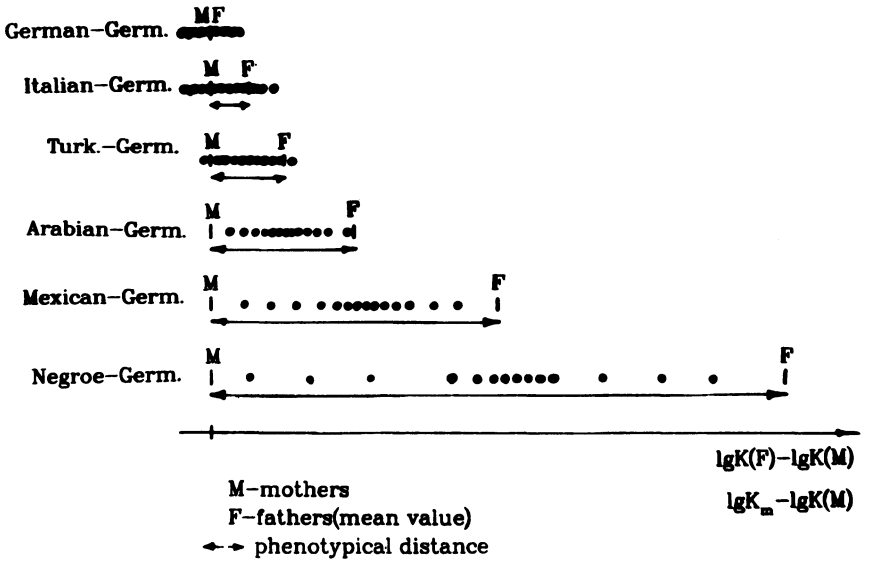

Fig. 1. Scattering of the lgK value of 14 children around the mean lgK values of their parents; in all cases a German mother, the fathers variously German, Italian, Turkish, Arab, urban Mexican and Black US American (schematic presentation).

[1] K = f(II)/f(I), where f(II) is the frequency of a person's phenotype in the alien and f(I) that in the German population (cf. previous article).

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In all cases the lgK values of the children are clustered in the range between those of their respective parents (in accordance with known distribution curves).
The smaller the phenotype distance between the parents lgK values the greater the likelihood that the lgK values of their children will scatter beyond this range, and vice versa. As this "phenotype distance" increases so does the lgK distance of children from the lgK value of the mother. The lgK values of the children become increasingly indicative of an alien father; accordingly, the probability of a German father decreases.

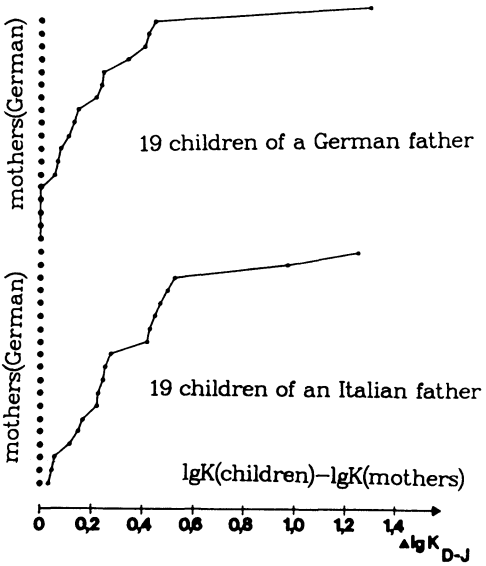

Fig. 2. Differences between the lgK values of child and German mother for 19 children with a German and 19 children with an Italian father.

Fig. 2 shows that the lgK differences between mother and child, on the whole, are greater if the father is Italian.

This behaviour is useful in cases of putatively alien paternity, for it opens up the possibility of determining the numerical probability of such parentage from findings for the child.

The mathematical basis of this phenomenon can be demonstrated with the example of a single blood group system.
The blood group system may include the combinant genes *1 and *2 as well as 3 phenotypes (= genotypes): 1, 2-1 and 2. Let us assume the following gene frequencies for the German and alien populations:

	frequencies	
genes	German	alien
*1	a1 = 0.9	a'1 = 0.1
*2	a2 = 0.1	a'2 = 0.9

Let mother and child possess the genotype 1-1. According to hy-

pothesis X the child's father is alien, according to hypothesis Y German. The frequency of the former will then be

$f(X) = a_1 \cdot a_1 \cdot a'_1$

(= frequency of the maternal genotype) (= frequency of the gene the child has inherited from the father)

$= 0.9 \cdot 0.9 \cdot 0.1 = 0.081,$

and the frequency of the latter

$f(Y) = a_1 \cdot a_1 \cdot a_1$

$= 0.9 \cdot 0.9 \cdot 0.9 = 0.729.$

The probability of hypothesis X is thus

$W_X = f(X)/f(X)+f(Y) = 0.081/(0.081+0.729) = 0.1.$

Hence, in this case there is a probability of 10% that a child with the genotype aa will have an alien father; the probability of a German father is 90% - conditional on a neutral prior probability.

To combine the results from several systems one multiplies the likelihood ratios $L_1, L_2, \ldots, L_n$:

$f(Y_1)/f(X_1) \cdot f(Y_2)/f(X_2) \cdot \ldots \cdot f(Y_n)/(X_n).$

The probability of hypothesis X (in %) tells one how often one would be correct if in 100 analogous cases one categorically decided in every case that the child's father was alien; the probability of hypothesis Y tells one how often one would be correct if in every case one assumed the father of the child was German (given the assumption of a neutral prior probability). -

The greater the frequency differences between the two populations concerned the clearer the indication of the alien father's ethnicity. Decisions are possible from W = 90% upwards.

One will calculate W_X or W_Y only if there is a prospect of obtaining a reasonably high W value (e.g. $W \geq 90\%$). In other words, before applying this method one should consider the conditions of the case in question, taking account of a) the ethnic situation and b) the type and number of gene systems included.

Because the lgY/X values for German and alien fathers do not have a normal distribution, and because the number of cases dealt with in practice is as yet too small, one must of necessity resort to simulation using adequate gene frequencies. We have simulated between 2000 and 4000 mother-child doublets in 15-21 systems. Table 1 gives the results.

Table 1. Proportion (in %) of triplets with German and alien father respectively, for which, with $W \geq 90\%$, the German or alien origin of the father was established from the lgK difference between mother and child (2000-4000 simulated triplets in 15-21 systems).

ethnic origin of the father	cases in favour of an alien father	cases in favour of a German father	mother-child doublets	number of systems
Italian	0,2%	1,5%	3000	21
Turkish	0,4%	4,4%	3000	21
Spanish	2,8%	2,5%	4000	20
Indian	2,8%	7,6%	3000	15
Arab	9,1%	13,4%	3000	18
urban Mexican	18,5%	15,7%	3000	18
USA Black	56,7%	62,7%	2000	19

If one makes the neutral assumption that in any one case there is an equal chance of the unknown father of the child being German or alien, then - depending on the ethnic distance between child and mother - one may assume with $W \geq 90\%$ that the father is of alien origin in between 0.2 and 56.7% of the cases and that he is of German origin in between 1.5 and 62.2% of the cases. A prerequisite for the correctness of these figures is, of course, that the father of the child in question is in fact either German or Italian, Turk, etc.

Often it is difficult to tell from a child's appearance whether its father is e.g. Italian, Turk, Spanish, etc. In these cases one should try to establish the probability of alienness of the father from the blood group findings for mother and child. This may help the court to reach a decision in keeping with the truth of the situation.

References

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