# PROBABILITY OF EXCLUSION (PE) OF THE HLA-A,B SYSTEM IN NORTH AMERICAN WHITES AND BLACKS

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## Introduction

Although it is well known that the HLA system is the single most powerful genetic system commonly used in parentage testing, its efficiency with currently available antisera in excluding a falsely accused man has not been well documented. Various estimates have yielded values which range from 86-96%.[1-4] This value will, of course, vary with the number of known alleles, their gene frequencies, the extent of testing, and the criteria used to define the antigens.

## Methods

Two commercial HLA typing trays were used for each individual typed. Criteria utilized for antigen definition conformed to the Standards for Parentage Testing Laboratories* of the American Association of Blood Banks.[5]

An observed estimate was obtained by moving the alleged father forward one case in the chronological sequence of paternity test cases in our archives from the last five years. The assumption was made that all of the alleged fathers were then false fathers and the HLA system was utilized alone to determine if these false fathers could be excluded. The artificially created trios were examined individually by each of the co-authors for evidence of an exclusion.

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*Each HLA antigen must be tested on two different trays and be defined by at least two different operationally monospecific sera, or by one monospecific serum plus two multispecific sera or by three multispecific sera.



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## Results

Approximately 18 A and 25 B locus specificities were recognized using multiple antisera for definition. The total number of artificial trios examined, the number of observed exclusions, and the power of exclusion, expressed as a percentage, are displayed in the table below:

Observed Exclusion Frequency in Artificial Trios

| | No. | | % |
|---|---|---|---|
| Race | Artificial Trios | Observed Exclusions | Power of Exclusion |
| White | 461 | 431 | 93.5 ± 1.1 |
| Black | 128 | 118 | 92.2 ± 2.4 |
| | 589 | 549 | 93.2 ± 1.0 |

## Discussion

Examination of artificial trios is ideal in that it uses actual reported phenotypes rather than theoretical values and therefore considers serological and technical failures of antigen definition. It assumes that the artificial trios are indeed false and that the alleged fathers are always non-fathers, a rather safe assumption. The method is not reliable if different HLA reagents were used to define the antigens of the alleged father than were used for the mother and child. This problem is circumvented by the use of contiguous sequential cases from the same laboratory which utilized identical lots of reagents for all persons tested.[6]

The PE value of 93.5% for whites for the HLA-A,B system observed in this study does not differ significiantly from the 95.7% value reported by Mayr.[4] This difference could be due to chance random variation, gene frequency differences, failure to recognize some of the antigens present as a result of technical problems in processing, antisera failures, the rather strict criteria employed for the definition of HLA antigens, or a combination of two or more of these possibilities. In spite of the increased frequency of blanks in blacks, their PE value was comparable to that of the whites, probably due to the greater phenotypic heterogeneity in blacks at the A locus. This study does underscore the powerful utility of the HLA system in laboratory tests utilized for the resolution of parentage disputes.

References

1. Chakravarti A, Li CC. The probability of exclusion based on the HLA locus. Am J Hum Genet 1983; 35:1048-52.

2. Chakravarti A, Li CC. The effect of linkage on paternity calculations. In: Walker RH, ed. Inclusion probabilities in parentage testing. Arlington: Amer. Assoc. of Blood Banks, 1983:116.

3. Lamm LU, Gürtler H, Hansen HE. The HLA system. In: Walker RH, ed. Inclusion probabilities in parentage testing. Arlington: Amer. Assoc. of Blood Banks, 1983:389.

4. Mayr WR, Speiser P. HLA in paternity testing (abstract). Forensic Science International 1979; 14:117-8.

5. Standards for Parentage Testing Laboratories. Arlington: Amer. Assoc. of Blood Banks, 1984.

6. Lincoln PJ, Dodd BE. An analysis of over 1500 cases of doubtful paternity submitted for blood group investigation (abstract). Transfusion 1979; 19:663.