DNA Testing in Kinship Analysis

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We have successfully used RFLP DNA testing methods to perform kinship analyses of extended pedigrees as well as limited pedigrees such as sibships in both civil and criminal casework. The analysis uses DNA VNTR probes to examine the DNA profiles of test subjects and/or questioned evidence at up to twelve different genetic loci. Generally accepted genetic, statistical and population genetic techniques are used to generate a series of reports comparing the various possible ways in which the subjects may be related. The method of analysis is the Baysian approach. The likelihood ratio for each genetic locus, given the hypothetical relationships and patterns of genetic types, is expressed as a formula whose variables are the frequencies of the genetic traits.

In the "Hillblom" sibship case, GeneLex Corporation was asked to determine if five children, each with a different mother could be the offspring of L. Hillblom, the deceased founder of DHL courier service. In this high profile civil case, the Attorney General of California represented the estate; a mole purportedly excised from L. Hillblom was unavailable for testing, as were Hillblom's mother and full brother. Therefore, an indirect strategy was employed- proving a relationship among his geographically disparate alleged children. Seven other DNA testing laboratories were involved either at sample collection, retesting or case review. GeneLex tested twelve RFLP loci. The allele frequency data obtained was used to calculate the probability of half-sibship or unrelatedness in a series of comparisons between different combinations of the five tested mother/child pairs. In general, the more genes that two children have in common, the more likely it becomes that they have a common parent. A cumulative half-sibship likelihood ratio of less than one suggests that the individuals do not have the same father. A cumulative half-sibship likelihood ration of greater than one suggests that they do. In this case, one of the children was excluded at multiple genetic loci. Comparisons among the four apparently related children indicated that the data is at least 40 million times more likely if all four have the same father than if any one of them is unrelated. The genetic evidence could also be explained by assuming a common grandfather, although this explanation is 100 times weaker than the explanation that they have the same father. Incidentally, the father's DNA profile could be reconstructed from the data in this case- but of course only in retrospect, after sibship is proven.

A typical example of testing an extended pedigree is when the alleged father is deceased and subjects tested include the mother(s), child(ren), alleged paternal grandparent(s) and/or alleged paternal sibling(s). The probability of paternity as well as the probability of grandparenthood can be calculated. It is not possible to obtain a direct exclusion in many of these cases. The most difficult cases to resolve involve the testing of two children, when the question is of full-sibship versus half-sibship. In cases such as these, analysis using 10-12 RFLP loci becomes extremely important to the statistical resolution of the case. The STR DNA batteries currently in use do not yet have the discriminatory power to resolve such complex kinship cases.