

NUANCES AND PITFALLS IN CRIMINAL DNA RELATIONSHIP TESTING

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While forensic crime laboratories are experienced in statistically comparing DNA profiles from evidence to reference profiles, they are often not as familiar with relationship testing in cases of incest. These types of cases constitute only a very small portion of their caseload and most crime laboratories are not accredited for relationship testing. Here we describe an unusual non-criminal paternity case to illustrate some of the problems that can be encountered in relationship testing.

The case involved an alleged paternity relationship. Initial testing of the alleged father and male child with 15 autosomal genetic loci using the AmpF ℓ STR Identifiler kit (Life Sciences, Inc.) resulted in a single genetic inconsistency at vWA. By convention mandated by the nationally accepted accreditation body, AABB, a single inconsistency does not constitute an exclusion of the alleged male as the biological father. A standardized mutation frequency specific for that locus was integrated into the calculation of the likelihood ratio referred to as a combined paternity index (CPI). The resulting combined likelihood ratio for Caucasians was 207, with a probability of 99.53%, well above the established likelihood legal threshold of 100 (probability of 99%). There was still only one inconsistency (vWA) when the mother's DNA profile was added to the analysis resulting in a CPI of 170,000 and a probability of >99.999%. Even when six additional autosomal genetic markers were added to the analysis, there was still only the vWA inconsistency resulting in a very compelling CPI of 399 million, indicating that it is 399 million times more likely the tested individual is the biological father than a random Caucasian male.

A common defense in criminal relationship cases is to claim that a related individual may be the actual biological father and the defendant is falsely implicated. So as a precaution, our standard practice is to determine the statistical probability that an untested related individual may be the biological father. Incorporating the full 21 autosomal loci and the mother's DNA, the tested alleged father was 14.6 times more likely to be the biological father than an untested sibling of the tested individual. An untested grandfather to the alleged father is 8540 times less likely to be biological father than the tested individual. However, it was revealed that a sibling of the tested individual may indeed be the father. Testing of that individual resulted in no inconsistencies and, when analyzed with the mother's DNA profile and the 22 autosomal markers, the resulting CPI was 4.5 billion. Thus the second individual was 588 times more likely to be the biological father than the original tested male. Thus contrary to the statistical analysis that indicated that it was 14.6 times more likely that the first tested male is the biological father, the second male was actually 588 times more likely to be the biological father. In conclusion, statistical analyses for related individuals should be done for all criminal relationship DNA tests but this case dramatically illustrates that those statistics may be erroneous.