



Can DNA 'Witness' Race?: Forensic Uses of an Imperfect Ancestry Testing Technology

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Can DNA 'Witness' Race?: Forensic Uses of an Imperfect Ancestry Testing Technology Duana Fullwiley

On August 11, 2004, an African-American man named Derrick Todd Lee was convicted for the first of a series of murder and rape cases in south Louisiana. In the early 2000's, seven women in the Baton Rouge area had been violently murdered by a serial killer.¹ Lee's eventual convictions were largely based on his Y-chromosome STR DNA profile that matched DNA from samples found on the serial victim's bodies. Before this, however, Lee's DNA underwent a specific genetic analysis that attempted to place him within one of four continental racial groups. Thus, Lee was the first person in the United States to be identified as a possible suspect by an unconventional DNA test that racially profiled his DNA left at a crime scene.

The technology that purported to read Lee's race in his DNA is trademarked as "DNAWitness." The name is not accidental. Its inventors at DNA Print Genomics Inc. want to convey the idea that this technology itself embodies the power of the 'expert witness' through literal genotypes, or "base-calls," of the perpetrator's specific DNA nucleotide pairs. Forensic analysis with "DNAWitness" is, quite simply, a comparison of a sample of unknown origin with a panel of genetic markers called Ancestry Informative Markers, or AIMs.

The basic process of an AIMs analysis consists of a comparative exhibition of varying autosomal coding markers and their relative frequencies in four world populations. The goal of this specific iteration of the AIMs test, packaged only for forensics as DNAWitness, is to infer the aggregate of phenotypes associated with any one racial category in the United States. Such an inference is based on the extent to which the anonymous sample expresses allelic variations of markers comprised in a panel that is thought to differ in people from the continents of Africa, Asia, Europe, and (pre-Columbian) America (see endnote 1). In the case of the south Louisiana serial killer, DNAWitness yielded 'ancestry estimates' that the perpetrator's genetic makeup was 85% sub-Saharan African and 15% Native American. The Louisiana task force's previous search for a 'Caucasian' male was thereafter deemed to be potentially off the mark. The suspect, as deduced by DNAWitness, was most likely a 'lighter skinned black man' as inferred from probabilistic ancestry percentages revealed in the perpetrator's DNA.

In this article I examine the use of DNAWitness to determine the prospective race of a suspect in order to provide evidence to law enforcement for narrowing a suspect pool. I argue that DNAWitness falls short of legal and scientific standards for trial admissibility and eludes certain legal logic concerning the use of racial categories in interpreting DNA. DNAWitness can offer vague profiles in many cases, and has a wide margin of error that too often absorbs what might be understood to be important aspects (i.e. substantial percentages) of ancestral heritage and of a forensic 'racial profile.' Moreover, this technology's individual ancestry estimates are highly vulnerable to social and political interpretations of phenotype, and may be impossible to accurately interpret with a sufficient degree of objectivity, required of both science and law. It is possible, however,

that this test may help to predict a range of skin color phenotypes, as was the case for Lee, since many of the AIMs are skin and hair pigmentation alleles.

The AIMs technology, (again, packaged with different names depending on the market and client) as manufactured by DNAPrint Genomics, is specifically designed to assess allelic frequency differences of coding DNA, or Single Nucleotide Polymorphisms. This is important, since markers that the test makers interpret as 'African' or 'European', for example, are also found in other world populations that differ from the prior continental referent populations (African, European, Native American and Asian) used by the company in both name and geographic location. This is to say that differences in ancestry profiles may be due to evolution, gene flow, genetic convergence, or genetic drift. The presentation of DNAWitness test results demonstrates no attempt to distinguish between these different mechanisms of locus possession in individuals or in groups. Direct and unique ancestry (gene flow) is but one among several mechanisms that might explain shared sequence variation among and between racialized individuals. The simple description of a certain frequency, or set of frequencies, as 'African' ancestry may constitute a false designation of 'racial type,' while, conversely, it might not. The fact that there is no gold standard for this technology (a specific proprietary test) should make the legal community pause before lauding its potential success and eventual adoption on a broad basis.

From the outset, before evaluating scientific criteria for admissibility in a trial setting, it must be clarified that DNAWitness has not been used at the trial stage, but rather at the pre-trial stage as prospective information for investigating officers. Nonetheless, it is critical to consider the scientific standards for legal admissibility to shed light on the ways in which this technology may actually do harm in the courtroom, since its scientific shortcomings can be easily identified with regard to admissibility rules. Furthermore, holding this technology to accepted legal standards with regard to 'expert' use of science and technology will also allow us to better understand DNAWitness' problematic role in the legal setting at any stage.

Legal precedent would have us focus on three federal cases to determine how scientific merit constitutes the rules for admissibility in a court of law: *Daubert v. Merrell Dow Pharmaceuticals, General Electric & Co. v. Joiner*, and *Kumho Tire Co., Ltd v. Carmichael*. Issues of a)"reliability," b)"scientific validity," and c) whether techniques "can be tested" and "falsified" are of critical concern. As stated in *Daubert v. Merrell Dow*, "scientific methodology today is based on generating hypotheses and testing them to see if they can be falsified; indeed, this methodology is what distinguishes science from other fields of human inquiry."² More specifically, a "non-exclusive checklist for trial courts to use in assessing the reliability of scientific expert testimony," provided in Notes to 702, Federal Rules of Evidence, includes:

- (1) "whether the expert's technique or theory can be challenged in some objective sense, or whether it is instead simply a subjective, conclusory approach that cannot be reasonably assessed for reliability;
- (2) whether the technique or theory has been subject to peer review and publication;

- (3) the known potential rate of error of the technique or theory when applied;
- (4) the existence and maintenance of standards and controls; and
- (5) whether the technique or theory has been generally accepted in the scientific community."³

DNAWitness fails to meet this basic checklist on four out of the five items. (It has been subjected to peer review, as AIMS, in several research studies for means other than inferences of racial phenotype.)

Notwithstanding that these Federal Rules were established for the use of scientific evidence in a court of law independent of DNA testing, they nonetheless hold for all scientific evidence.⁴ Effective December 1, 2000, several amendments to the rules, namely with regard to procedure and methods of reliability, made it clear to both the bench and bar "that an attack on the procedure used to test DNA for evidentiary purposes can be an effective challenge to the weight of any DNA evidence admitted."⁵ Thus, presenting genetic results in less than exact and recognized ways could prove detrimental to case arguments.

The rise of new genetic technologies in the past two decades has yielded a range of scientific possibilities for the courts. Not all genetic tests perform the same kinds of tasks, and none were instituted without prolonged discussion, debate, and research consensus with regard to their reliability and consistency among scientists and law enforcement.⁶ As this brief discussion makes clear, DNAWitness is based on Ancestry Informative Marker technology, or coding SNPs, that are largely shared among individuals and groups for varying reasons—reasons that are neither described nor acknowledged explicitly in the test results offered by DNAPrint. AIMS-based technologies, like DNAWitness, are attempts to model human history from a specifically American perspective to infer present-day humans' continental origins.⁷ Such inferences are based on the extent to which any subject or sample shares a panel of alleles (or variants of alleles) that code for genomic function, such as malaria resistance, UV protection, lactose digestion, skin pigmentation, etc. There is a range of such traits that are conserved in, and shared between, different peoples and populations around the globe for evolutionary, adaptive, migratory, and cultural reasons. To assume that people who share, or rather co-possess, these traits can necessarily be 'diagnosed' with a specific source ancestry is misleading. Not only will siblings often share the same profile—or not—but individuals from all four 'parental' continental groups offered up by the model could feasibly share similar profiles—or not. As a forensics market version of the AIMS technology, DNAWitness may offer precise mathematical ancestry percentages, but the accuracy of that precision remains debatable.

At best, this technology is an experimental modeling tool that hopes to mimic recent American human history as it reconstructs four racial types through an artificial homogenizing of markers found with relatively higher frequencies on some continents and lower frequencies on others. As compelling a tool as DNAWitness may seem, investigators should require that DNA analyses used in the serious proceedings of law be

falsifiable, reliable, and thoroughly vetted. Anything less would prove irresponsible if incorporated into criminal investigations.

Endnotes

1. The same technology, produced by DNAPrint Genomics, is also packaged as AncestrybyDNA for recreational genealogical ancestry testing. It is also used in biomedical research settings for purposes of admixture mapping for disease traits and to prevent confounding in 'mixed' populations in case-control studies for complex disease traits. See <http://www.dnaprint.com/welcome/productsandservices/index2.php> (Accessed March 28, 2008).

References

1. P. Roberts, Sunday Advocate, 1 June 2003, p. 1A.
2. Daubert v. Merrell Dow Pharmaceuticals, 509 US 579 (1993).
3. Notes to Fed. R. Evid. 702, <http://www.law.cornell.edu/rules/fre/ACRule702.htm>.
4. E. Imwinkleried, in DNA and the Criminal Justice System: The Technology of Justice, D. Lazer, Ed. (Cambridge: MIT Press, 2004), chap. 5, p. 98-99.
5. E. Imwinkleried, in DNA and the Criminal Justice System: The Technology of Justice, D. Lazer, Ed. (Cambridge: MIT Press, 2004), chap. 5, p. 99.
6. National Research Council, The Evaluation of Forensic DNA Evidence, Committee on DNA Forensic Science: An Update (Washington DC: National Academy Press, 1996)
7. T. Frudakis, Molecular Photofitting: Predicting Ancestry and Phenotype Using DNA (Burlington, MA: Academic Press, 2007), p. 429.