

AN ON-DEMAND DNA INFORMATION COMMUNITY

Ria David¹, Karl E. Williams, MD, MPH², Mark W. Perlin, PhD, MD, PhD¹

¹Cybergenetics, Pittsburgh, PA USA

²Office of the Medical Examiner, Allegheny County, PA USA

DNA information is a crucial currency of criminal identification. In the current forensic DNA model, biological crime scene evidence is processed by a DNA laboratory producer, which both generates and interprets electronic data. The lab then notifies DNA information consumers, such as police, prosecutors and defense.

With the advent of lab automation, though, machines are generating ever greater quantities of more challenging data. Painstaking human review of difficult data is slow and expensive, and loses considerable identification information [1]. This information loss (discarding informative data as "inconclusive", or reducing match strength a million-fold) devalues the DNA information currency.

Computer-based probabilistic genotyping (SWGDM 2010, 3.2.2) can eliminate this interpretation bottleneck. Allegheny County in Pennsylvania has been pioneering an approach to "on-demand" DNA interpretation that serves its criminal justice community. In this new DNA processing paradigm, the crime lab identifies challenging data, and forwards it electronically to their interpretation partner Cybergenetics for computer processing. Within days, the company sends a TrueAllele[®] match report to the prosecutor or other DNA information consumer. The laboratory is thus relieved of a "challenging DNA" interpretation burden, and the information needs of the county's criminal justice community are met, with great speed at low cost.

In a recent serial rape case, the key evidence was a DNA mixture having a minor contributor that matched the suspect with a CPI of 10^5 . More could be done. So the lab gave the data to Cybergenetics for TrueAllele processing, and within two days the prosecutor received a LR match score of 10^{15} . DNA evidence from a second victim with a CPI of 10^6 was later delivered to Cybergenetics, who found a 10^{12} TrueAllele LR match from a 10% minor component to the same suspect. The police and prosecutor received this second match information dispatch within two days of submission, in time for a trial 10 days later.

Another state recently adopted this "lab generates, computer interprets" information model. The state lab had processed challenging mixture items in over 100 important cases where SWGDAM's new "stochastic thresholds" threatened the courtroom viability of important DNA evidence. These data were sent to Cybergenetics to build a "library of DNA truth" containing DNA match scores for every item. As cases go to court, prosecutors and defense will check out from this pre-processed information library, requesting reports "on-demand".

The future of DNA evidence lies in "truth-seeking" computer interpretation of challenging cases. Totally objective and informative probabilistic genotyping can help a community solve crimes using previously "inconclusive" DNA evidence. As the ongoing public-private partnership

in Allegheny County demonstrates, criminal justice can be better served by empowering crime laboratories with interpretation computers.

References:

[1] Perlin MW, Legler MM, Spencer CE, Smith JL, Allan WP, Belrose JL, Duceman BW. Validating TrueAllele® DNA mixture interpretation. *Journal of Forensic Sciences*. 2011;56(November):in press.