

No DNA Left Behind: When "inconclusive" really means "informative"

Schenectady County District Attorney's Office
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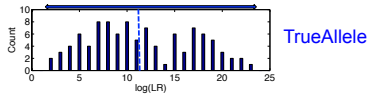


Cybergenetics

Cybergenetics © 2003-2014

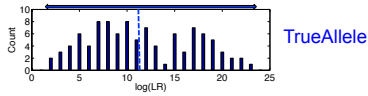
True DNA match information

11.05 (5.42)
113 billion

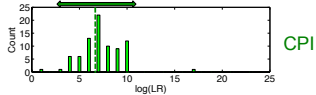


Pre-2010 human mixture review

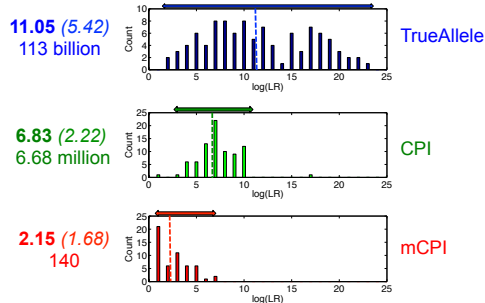
11.05 (5.42)
113 billion



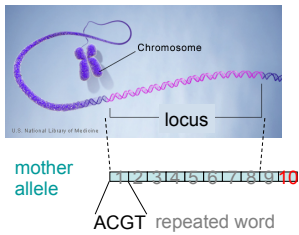
6.83 (2.22)
6.68 million



Post-2010 human mixture review



DNA genotype



A genetic locus has two DNA sentences, one from each parent.

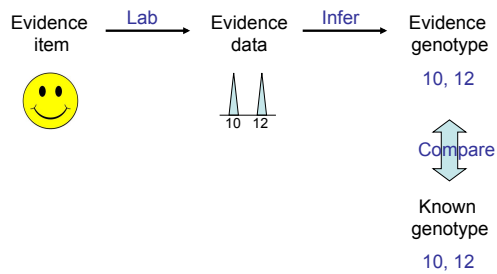
An **allele** is the number of repeated words.

A **genotype** at a locus is a pair of alleles.

10, 12

Many alleles allow for many many allele pairs. A person's genotype is relatively unique.

DNA identification pathway



Match information

At the suspect's genotype,
identification vs. coincidence?

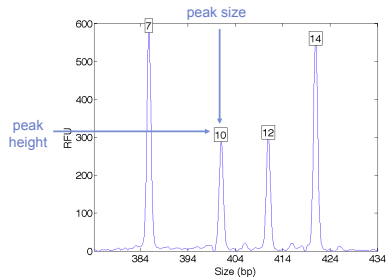
$$\frac{\text{Prob}(\text{evidence matches suspect})}{\text{Prob}(\text{coincidental match})} = \frac{100\%}{5\%} = 20$$

↑ data

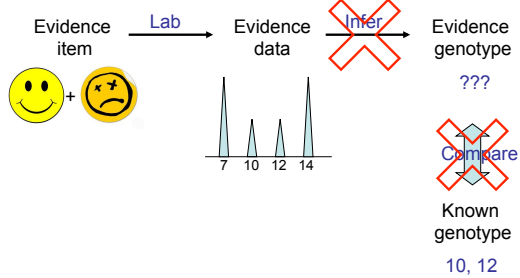
after (evidence) / before (population)

DNA mixture data

Quantitative peak heights at a locus



DNA pathway broken



Human interpretation issues

Evidence

- call good data inconclusive
- peaks are too low for them
- too many contributors to handle
- potential examination bias

Database

- hit by association, not by match
- comparison: make false hits
- restrict upload: lose true hits

TrueAllele® Casework

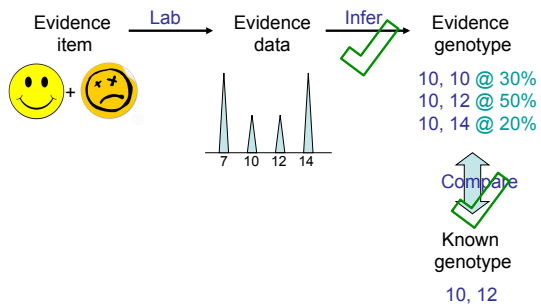
Evidence

- preserve data information
- use all peaks, high or low
- any number of contributors
- entirely objective, no bias

Database

- hit based on LR match statistic
- sensitive: find true hits
- specific: only true hits

DNA pathway restored

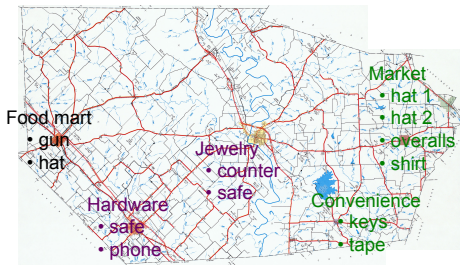


Match information preserved

At the suspect's genotype,
identification vs. coincidence?

$$\begin{array}{l}
 \text{after} \\
 \text{(evidence)} \\
 \uparrow \text{data} \\
 \text{before} \\
 \text{(population)}
 \end{array}
 \frac{\text{Prob}(\text{evidence matches suspect})}{\text{Prob}(\text{coincidental match})} = \frac{50\%}{5\%} = 10$$

Gang DNA from 5 crime scenes



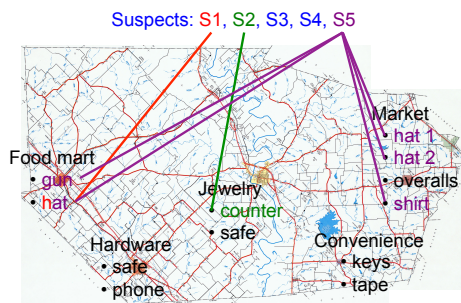
Laboratory DNA processing

- | | |
|-------------------|--------------------|
| 12 evidence items | 10 reference items |
| Scene 1 • gun | 5 victims |
| • hat | • V1 |
| Scene 2 • safe | • V2 |
| • phone | • V3 |
| Scene 3 • counter | • V4 |
| • safe | • V5 |
| Scene 4 • keys | 5 suspects |
| • tape | • S1 |
| Scene 5 • hat 1 | • S2 |
| • hat 2 | • S3 |
| • overalls | • S4 |
| • shirt | • S5 |

Cybergentics TrueAllele® timeline

Day	Activity
1	Received evidence data from lab
2	Started computer processing
4	Replicated evidence results
9	Received known references
10	Calculated DNA match statistics
12	Reported match results to lab

TrueAllele computer matches



DNA match statistic:
553 million

People of California v. Charles Lewis Lawton
and Dupree Donyell Langston
November, 2012
Bakersfield, CA

Admissibility hearing
and trial testimony



Peer-reviewed validations

Perlin MW, Sinenikov A. [An information gap in DNA evidence interpretation](#). *PLoS ONE*. 2009;4(12):e8327.

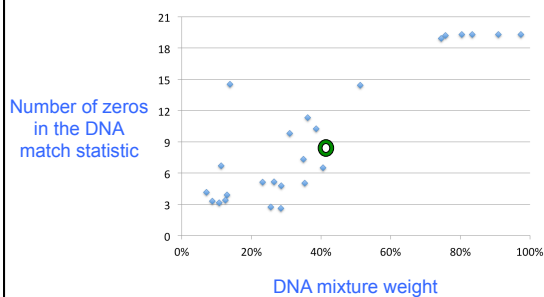
Perlin MW, Legler MM, Spencer CE, Smith JL, Allan WP, Belrose JL, Duceman BW. [Validating TrueAllele® DNA mixture interpretation](#). *Journal of Forensic Sciences*. 2011;56(6):1430-47.

Ballantyne J, Hanson EK, Perlin MW. [DNA mixture genotyping by probabilistic computer interpretation of binomially-sampled laser captured cell populations: Combining quantitative data for greater identification information](#). *Science & Justice*. 2013;53(2):103-14.

Perlin MW, Belrose JL, Duceman BW. [New York State TrueAllele® Casework validation study](#). *Journal of Forensic Sciences*. 2013;58(6):1458-1466.

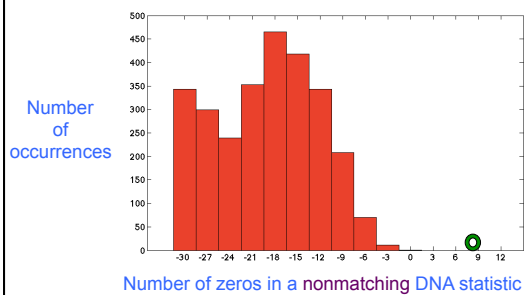


Expected match statistic



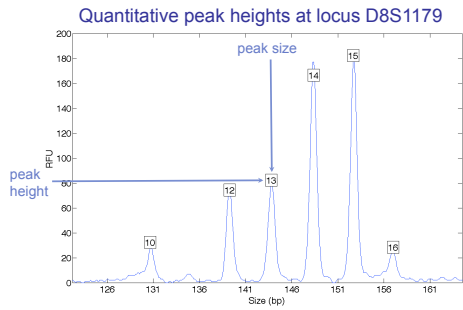


Specific match statistic



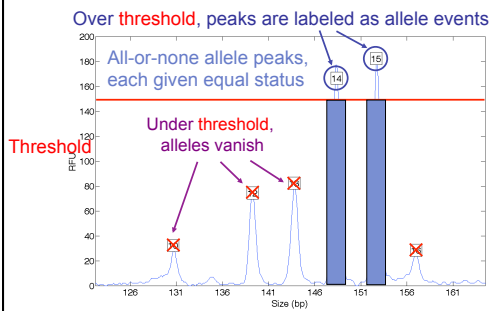


Computers can use all the data



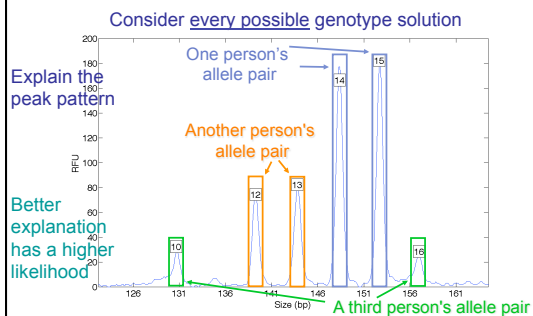


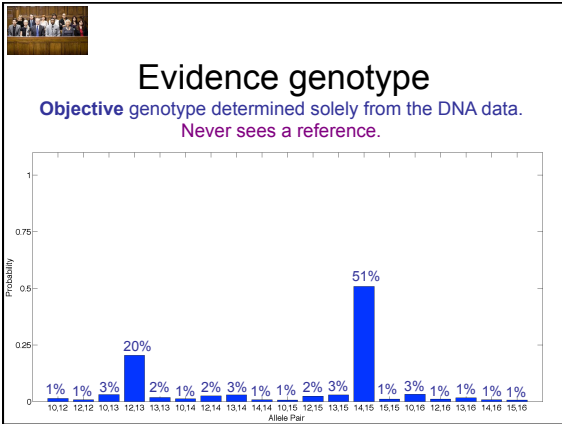
People may use less of the data

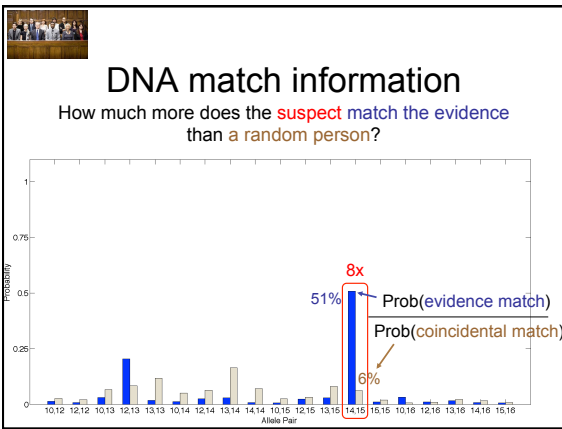


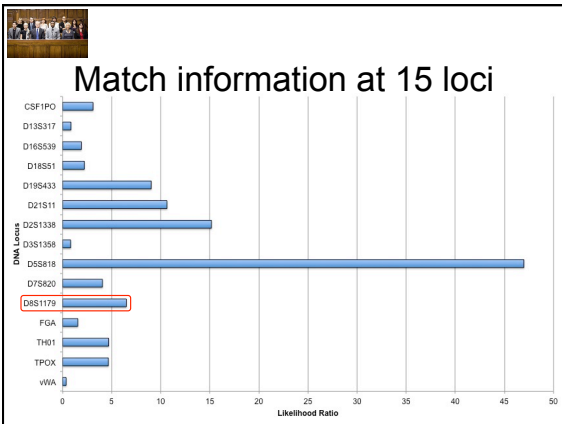


How the computer thinks











Is the suspect in the evidence?

A match between the front counter
and Dupree Langston is:

553 million times more probable than
a coincidental match to an unrelated Black person

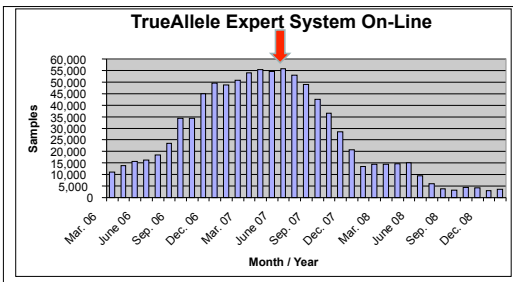
731 million times more probable than
a coincidental match to an unrelated Caucasian person

208 million times more probable than
a coincidental match to an unrelated Hispanic person





Eliminated NYS DNA backlog



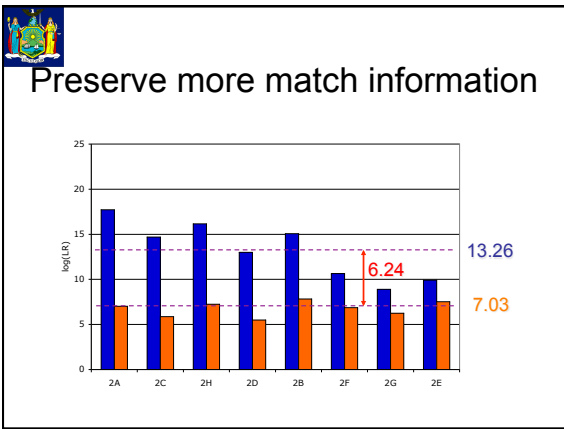
Reanalyzed WTC DNA data

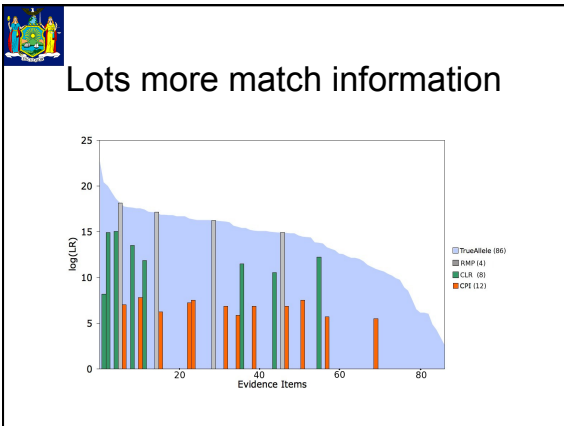
18,000
victim remains

2,700
missing people

match

The diagram shows a green arrow labeled 'match' pointing from a photograph of victim remains on the left to a photograph of missing people on the right. The text '18,000 victim remains' is in red, and '2,700 missing people' is in blue.







TrueAllele in New York State

Cybergenetics has analyzed DNA case evidence

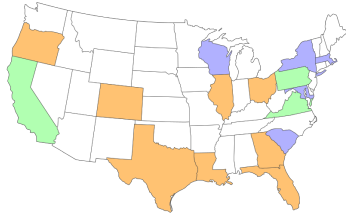
Counties:	Crimes:
• Cayuga	• murder
• Chemung	• rape
• Schenectady	
• St. Lawrence	
• Tompkins	
• Westchester	

TrueAllele in criminal cases

About 150 case reports filed on DNA evidence

Court testimony:	Crimes:
• state	• armed robbery
• federal	• child abduction
• military	• child molestation
• foreign	• murder
	• rape
	• terrorism
	• weapons

TrueAllele usage in the US



Casework system
Interpretation services
Admissibility hearing

TrueAllele computer age

Objective, reliable truth-seeking tool

- solves the DNA mixture problem
- handles low-copy and degraded DNA
- provides accurate DNA match statistics
- automates DNA evidence interpretation

Currently used to:

- eliminate DNA backlogs
- reduce forensic costs
- solve crimes
- find criminals
- convict the guilty
- free the innocent
- create a safer society

More TrueAllele information

<http://www.cybgen.com/information>



- Courses
- Newsletters
- Newsroom
- Presentations
- Publications

<http://www.youtube.com/user/TrueAllele>
TrueAllele YouTube channel



No DNA left behind

TrueAllele Casework at the NYS Police

- Installed
- Validated
- Trained
- Certified
- Documented

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Albany, NY
