**Virginia TrueAllele® Validation Study: Casework Comparison**

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**One person, one genotype**

![Diagram: One person, one genotype with locus and allele peaks](image)

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**DNA data**

One or two allele peaks at a locus

![DNA data graph](image)
Two people, two genotypes

DNA mixture data

Data summary – “alleles”
CPI information

Combined probability of inclusion

SWGDAM 2010 guidelines

Allele Pair
7, 7
7, 10
7, 12
7, 14
10, 10
10, 12
10, 14
12, 12
12, 14
14, 14

Higher threshold for human review

Modified CPI information

Cybergenetics © 2003-2017
SWGDAM 2010 guidelines

3.2.2. If a stochastic threshold based on peak height is not used in the evaluation of DNA typing results, the laboratory must establish alternative criteria (e.g., quantitation values or use of a probabilistic genotype approach) for addressing potential stochastic amplification. The criteria must be supported by empirical data and internal validation and must be documented in the standard operating procedures.

Use TrueAllele® Casework for DNA mixture statistics

Validated genotyping method


TrueAllele reinterpretation

The Washington Post

Virginia reevaluates DNA evidence in 375 cases
July 16, 2011

“Mixture cases are their own little nightmare,” says William Yosburgh, director of the D.C. police’s crime lab. “It gets really tricky in a hurry.”

“If you show 10 colleagues a mixture, you will probably end up with 10 different answers”
Dr. Peter Gill, Human Identification E-Symposium, 2005

Report mixture statistics

- 72 criminal cases
- 92 evidence items
- 111 genotype comparisons

Criminal offense
- 18 homicide
- 12 robbery
- 6 sexual assault
- 20 weapon

DNA mixture distribution
Mixture weight

Separate mixture data into two contributor components

25% 75%

Genotype inference

Thorough: consider every possible genotype solution
Objective: does not know the comparison genotype

Explain the peak pattern

Better explanation has a higher likelihood

Allele Pair

Victim's allele pair

Another person's allele pair

Sensitivity

The extent to which interpretation identifies the correct person

True DNA mixture inclusions

101 reported genotype matches
82 with DNA statistic over a million
TrueAllele sensitivity

TrueAllele specificity

Specificity

The extent to which interpretation does not misidentify the wrong person

True exclusions, without false inclusions

101 matching genotypes x 10,000 random references x 3 ethnic populations, for over 1,000,000 nonmatching comparisons
False positives
in over 1,000,000 comparisons per group

<table>
<thead>
<tr>
<th>Tail distribution</th>
<th>Black</th>
<th>Caucasian</th>
<th>Hispanic</th>
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<tbody>
<tr>
<td>0</td>
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<td>29</td>
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<tr>
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<td>8</td>
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<tr>
<td>3</td>
<td>0</td>
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<td>1</td>
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<tr>
<td>log(LR) &gt; 0</td>
<td>49</td>
<td>44</td>
<td>40</td>
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</tbody>
</table>

false positive rate is under 1 in 20,000 (0.005%)
for LR > 100, rate is 1 in 1,000,000 (0.0001)%

Reproducibility
The extent to which interpretation gives the same answer to the same question

MCMC computing has sampling variation

duplicate computer runs on 101 matching genotypes
measure log(LR) variation

TrueAllele reproducibility
Concordance in two independent computer runs

standard deviation (within-group) 0.305
Comparison

6.83 (2.22) 6.68 million

2.15 (1.68) 140

11.05 (5.42) 113 billion

Conservative results

Five matches, TrueAllele less than CPI.
Ten comparisons, no statistical support:
TrueAllele Virginia outcomes

144 cases analyzed
72 case reports – 10 trials

<table>
<thead>
<tr>
<th>City</th>
<th>Court</th>
<th>Charge</th>
<th>Sentence</th>
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<tbody>
<tr>
<td>Richmond</td>
<td>Federal</td>
<td>Weapon</td>
<td>50 years</td>
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<tr>
<td>Alexandria</td>
<td>Federal</td>
<td>Bank robbery</td>
<td>90 years</td>
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<tr>
<td>Quantico</td>
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<td>Rape</td>
<td>3 years</td>
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<td>Chesapeake</td>
<td>State</td>
<td>Robbery</td>
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<td>Arlington</td>
<td>State</td>
<td>Molestation</td>
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<td>Richmond</td>
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<td>Homicide</td>
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<tr>
<td>Hampton</td>
<td>State</td>
<td>Home invasion</td>
<td>5 years</td>
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</tbody>
</table>

TrueAllele today

- Invented math & algorithms: 20 years
- Developed computer systems: 15 years
- Support users and workflow: 10 laboratories
- Routinely used in casework: 7 crime labs
- Validate system reliability: 34 studies
- Educate the community: 50 talks
- Train & certify analysts: 200 students
- Go to court for admissibility: 10 rulings
- Testify about LR results: 50 trials
- Educate lawyers and laymen: 1,000 people
- Make the ideas understandable: 500 cases, 37 states

Conclusions

TrueAllele Casework DNA mixture interpretation is:

- A reliable method
  - objective
  - sensitive
  - specific
  - reproducible
  - accurate

TrueAllele computer genotyping is more effective than human review