

Revolutionising DNA analysis in major crime investigations

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Cybergenetics

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TrueAllele computer reanalysis

The Washington Post

Virginia reevaluates DNA evidence in 375 cases
July 16, 2011

“Mixture cases are their own little nightmare,” says
William Vosburgh, 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

Virginia mixture project

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

Criminal offense

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

Biological sample types

Sample type	Count
blood	10
epithelial/skin	30
fingernails	2
hair	1
saliva	4
semen	3
stain	1
touch	41

For each sample type, the table records how frequently that type was seen.

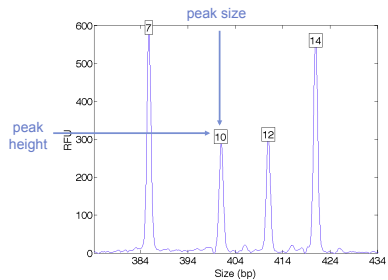
Number of contributors

	Contributors	Items
Estimate	2	40
	3	65
	4	8
Overlap	2 or 3	16
	3 or 4	3
	2, 3 or 4	1

When an item was consistent with more than one contributor number possibility, that item appears in multiple categories. The last three rows examine overlap situations where the number of contributors (first column) was uncertain, and counts the number of items (second column) in those situations.

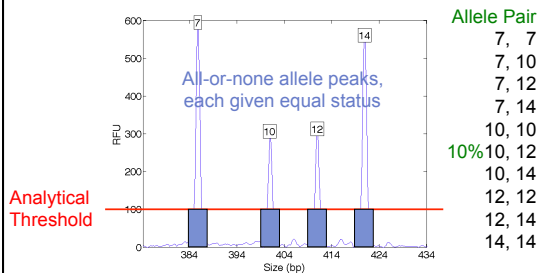
DNA mixture data

Quantitative peak heights at a locus



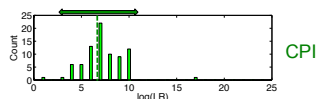
Data summary – “alleles”

Over threshold, peaks are labeled as allele events



Manual interpretation

6.83 (2.22)
6.68 million



Combined Probability of Inclusion (CPI)
analytical threshold

Random Man Not Excluded (RMNE)

2005: Not reproducible

National Institute of Standards and Technology
Two Contributor Mixture Data, Known Victim

Some Differences in Reporting Statistics

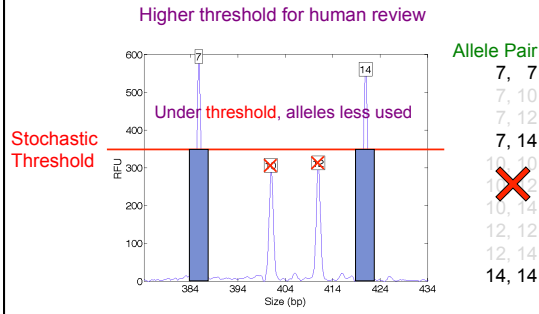
LabID	Kits Used	Caucasians	Africans	Hispanics
130	ProPlus/Collier	1.08E+15	2.13E+14	3.00E+15
34	ProPlus/Collier	2.40E+11	7.50E+09	9.80E+10
33	ProPlus/Collier	2.94E+08	1.12E+08	1.74E+09
6	ProPlus/Collier	42,000,000	3,500,000	260,000,000
9	ProPlus/Collier	1.14E+07	1.97E+07	1.54E+08
79	ProPlus/Collier	930,000	47,900	1,350,000
15	ProPlus/Collier	434,600	31,710	359,100

Remember that these labs are interpreting the same MIX05 electropherograms

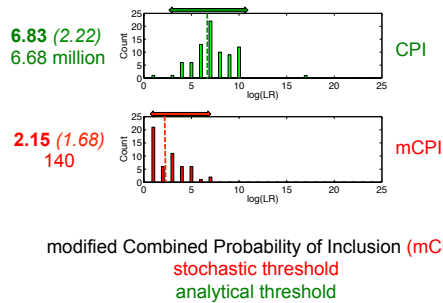
213 trillion (14)

31 thousand (4)

2010: New national guidelines



New manual interpretation

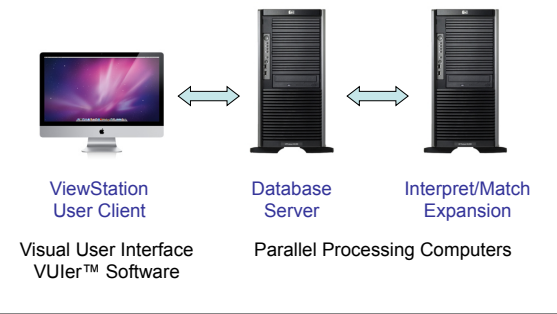


National guidelines provision

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.

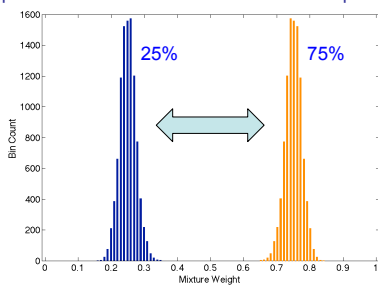
Use TrueAllele® Casework for DNA mixture statistics

Cybergenetics TrueAllele® Technology



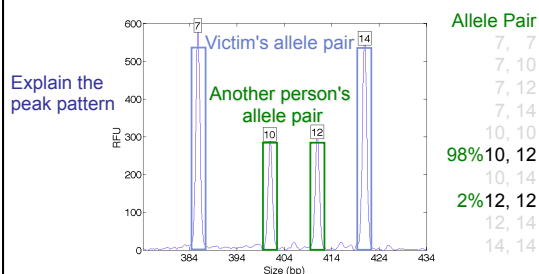
TrueAllele interprets mixtures

Separates mixture data into contributor components



Genotype probability

Use all data for computer analysis



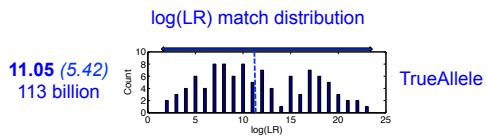
Sensitivity

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

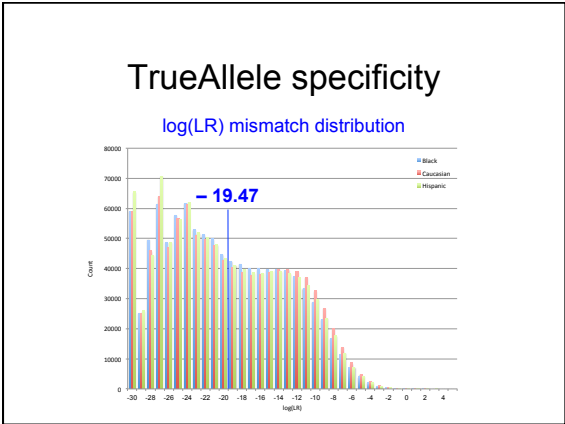


Specificity

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

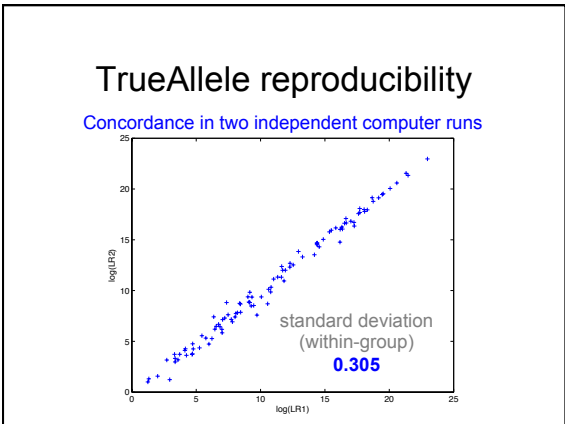


Reproducibility

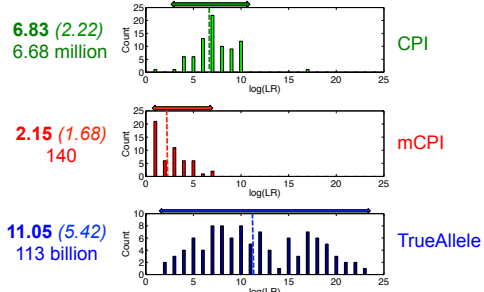
The extent to which interpretation gives the same answer to the same question

Statistical computing has sampling variation

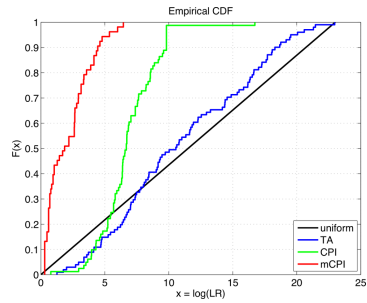
duplicate computer runs
on 101 matching genotypes
measure DNA match statistic variation



Mixture method comparison



Accuracy



Conservative results

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

Interpretation Method		Data Observations						
TrueAllele	CPI	mCPI	allele dropout	allele overlap	low peaks	peak imbalance	infeasible mixture	infeasible pattern
-10.64			3	4	1			1
-6.52			4	3	1			1
-5.05			4	3	1	1		1
-4.87				3		1	1	1
-4.86	3.48		4	1			1	
-3.22	6.04	6.34		2			1	1
-2.99	4.23		2		1		1	1
-2.18			2		1			1
-1.41	4.08		1		1			1
-0.67	2.95	0.60	1	2	1			

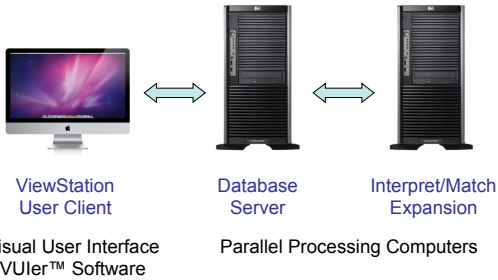
Ramsey Case: Fairfax, VA



Outside victim's home

- 5 year old girl abducted from home, molested and stabbed
- Jonathan Nathaniel Ramsey, age 16, accused of crime
- TrueAllele found a DNA match statistic of **916 million**
- Sentenced to 33 years in prison

Virginia TrueAllele® Technology



Lyons Case: Reading, PA



Glenn Lyons

- Woman stabbed 30 times, and left to bleed to death in her car
- Glenn Lyons accused of crime
- DNA match statistic (on same data)
 - Computer: **9,500,000,000,000**
 - Manual: **42,000**
- Convicted of first degree murder
- Death sentence for torture-murder

Investigation, degraded DNA mixture evidence, trial
