DNA Mapping the Crime Scene:
Do Computers Dream of Electric Peaks?

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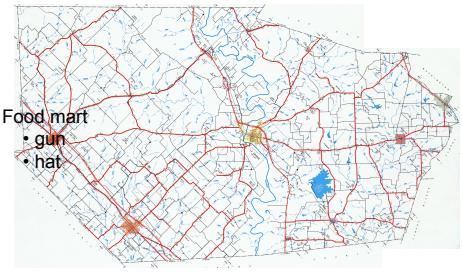
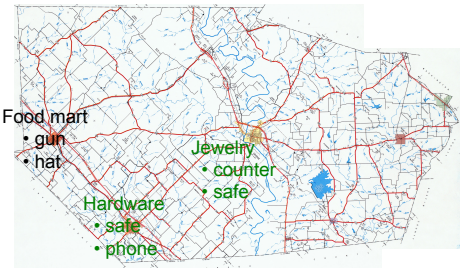
Cybergenetics

Cybergenetics © 2003-2012

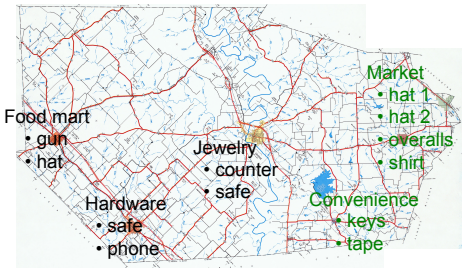
Gang crime



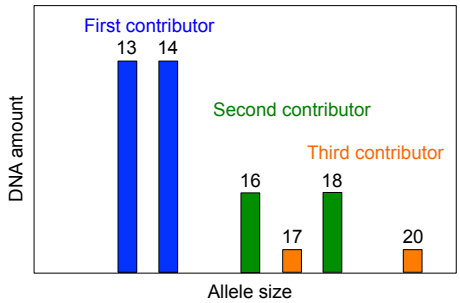
Escalation



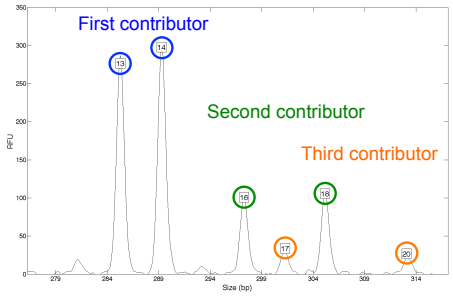
Evidence from multiple scenes



DNA evidence: genotypes



Develop STR data



Laboratory processing

12 evidence items

Scene 1
- gun
- hat

Scene 2
- safe
- phone

Scene 3
- counter
- safe

Scene 4
- keys
- tape

Scene 5
- hat 1
- hat 2
- overalls
- shirt

10 reference items

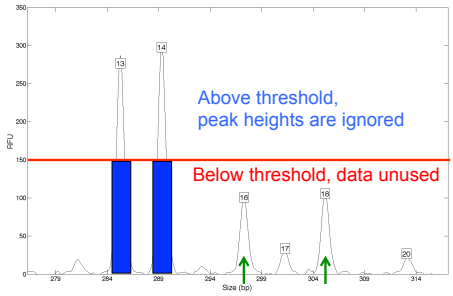
5 victims
- V1
- V2
- V3
- V4
- V5

5 suspects
- S1
- S2
- S3
- S4
- S5

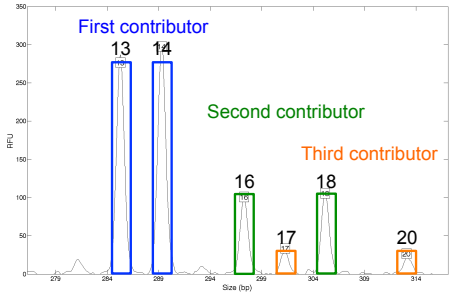
DNA match questions

log(LR)	Suspect 1	Suspect 2	Suspect 3	Suspect 4	Suspect 5
1. Gun					
1. Hat					
2. Safe					
2. Phone					
3. Counter					
3. Safe					
4. Keys					
4. Tape					
5. Hat 1					
5. Hat 2					
5. Overalls					
5. Shirt					

Human review: no results



Computers dream of electric peaks



TrueAllele® computes genotypes

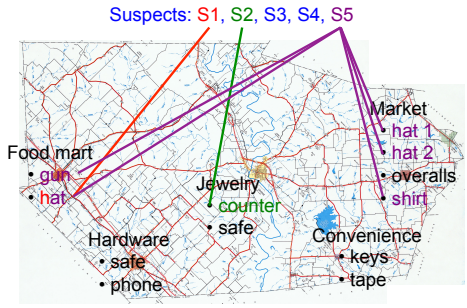
For each contributor, at every locus

Allele pair	Probability
16, 18	65%
14, 18	12%
13, 18	10%
18, 20	8%
17, 18	4%

TrueAllele match answers

log(LR)	Suspect 1	Suspect 2	Suspect 3	Suspect 4	Suspect 5
1. Gun					4
1. Hat	3				4
2. Safe					
2. Phone					
3. Counter		6			
3. Safe					
4. Keys					
4. Tape					
5. Hat 1					6
5. Hat 2					
5. Overalls					11
5. Shirt					3

DNA mapping the crime scene



Report results in court

A match between the evidence and the suspect is 12.3 trillion times more probable than a coincidental match to an unrelated Caucasian person

M. W. Perlin, "Easy reporting of hard DNA: computer comfort in the courtroom," *Forensic Magazine*, vol. 9, pp. 32-37, 2012.

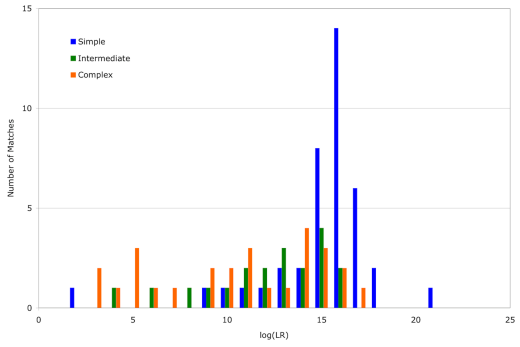
TrueAllele reliability

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

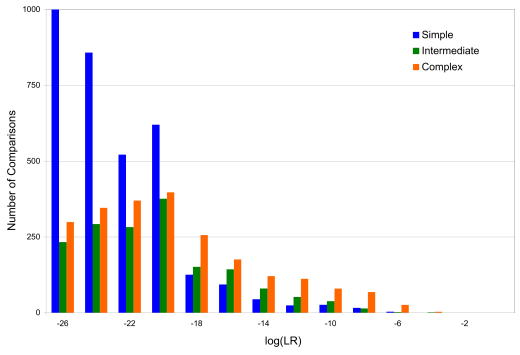
Perlin MW, Legler MM, Spencer CE, Smith JL, Allan WP, Belrose JL, Duceman BW. Validating TrueAllele® DNA mixture interpretation. *Journal of Forensic Sciences*. 2011;56(6):1430-47.

Perlin MW, Belrose JL, Duceman BW. New York State TrueAllele® Casework validation study. *Journal of Forensic Sciences*. 2013;58(6):in press.

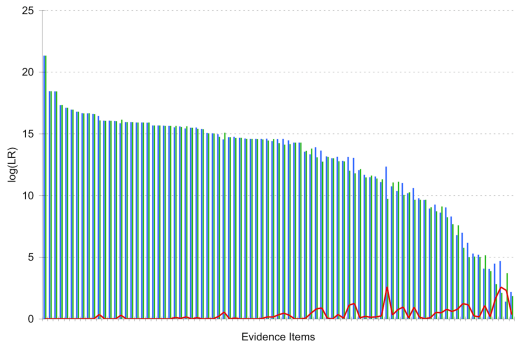
TrueAllele sensitivity



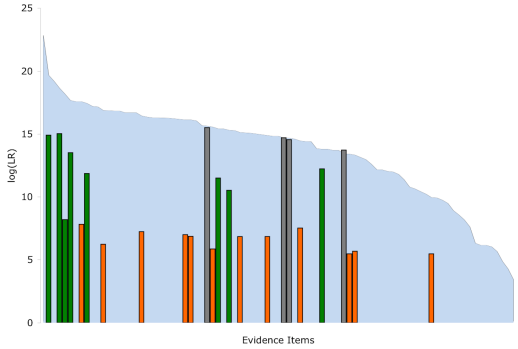
TrueAllele specificity



TrueAllele reproducibility



TrueAllele vs. People



TrueAllele in criminal trials

Over 100 case reports filed on DNA evidence

Court testimony:
- state
- federal
- military
- foreign

Crimes:
- armed robbery
- child abduction
- child molestation
- murder
- rape
- terrorism
- weapons

Poster 96 M. W. Perlin, "The Blairsville slaying and the dawn of DNA computing," in *Death Needs Answers: The Cold-Blooded Murder of Dr. John Yelenic*, A. Niapas, New Kensington, PA: Grelin Press, 2012.

TrueAllele precedent

Commonwealth of Pennsylvania v. Kevin James Foley

Superior Court, 2012

Future of DNA evidence

SWGDAM 2010: DNA mixture interpretation guidelines

wake-up call: interpretation of complex DNA mixtures must account for **data uncertainty**

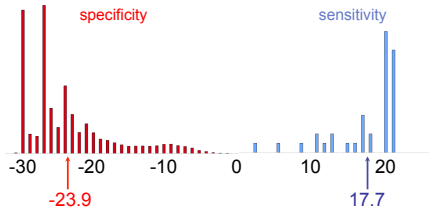
- end of older, less reliable, human review methods
- beginning of more reliable computer interpretation

§ 3.2.2 "probabilistic genotypes" & computers

M. W. Perlin, "Investigative DNA databases that preserve identification information," *American Academy of Forensic Sciences* 64th Annual Meeting, Atlanta, GA, 2012.

Genotype information database

Compare with 1,000 random genotypes



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 information

http://www.cybgen.com/information
- Courses
- Newsletters
- Newsroom
- Presentations
- Publications

Cybergenetics

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