

How TrueAllele® Works (Part 4) Genotype Database and DNA Investigation

Cybergenetics Webinar
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DNA evidence

Evidence

Reference

Crime scene

Possible suspect



genotype value x



Match



genotype value x

$$LR = \frac{1}{\Pr(X = x)}$$

Single source items, from one individual

Gill P, Werrett D. Interpretation of DNA profiles using a computerised database. Electrophoresis. 1990;11:444-8.

DNA database

Evidence

Reference

Genotype database

Genotype database



Match

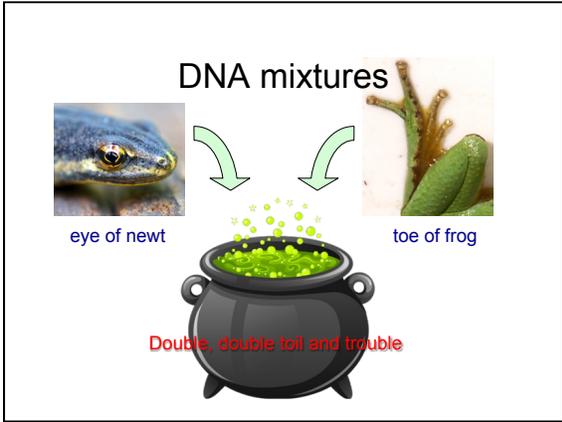
Upload ↑

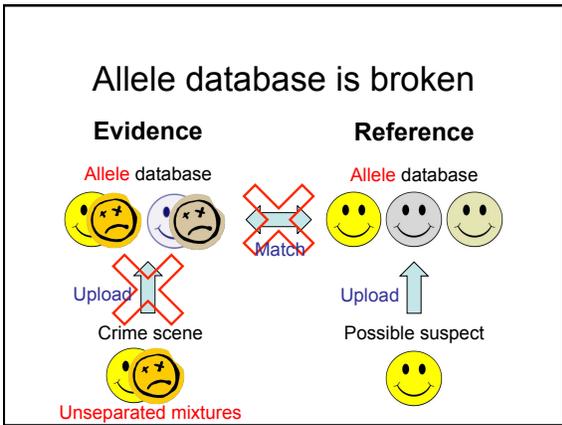
Upload ↑

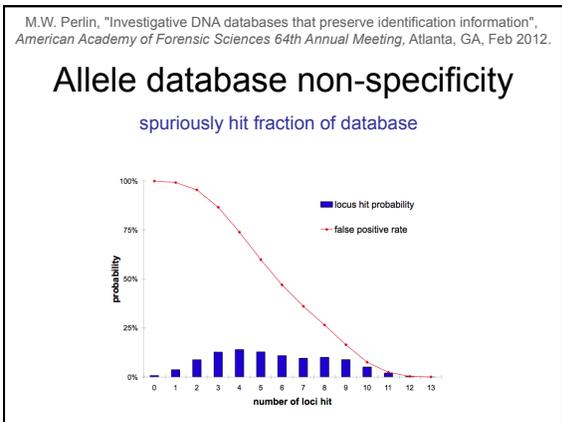
Crime scene

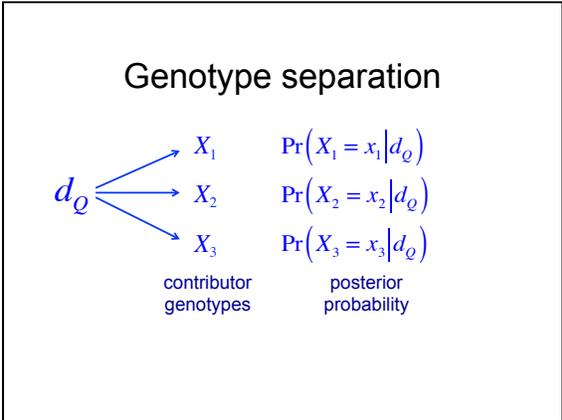
Possible suspect







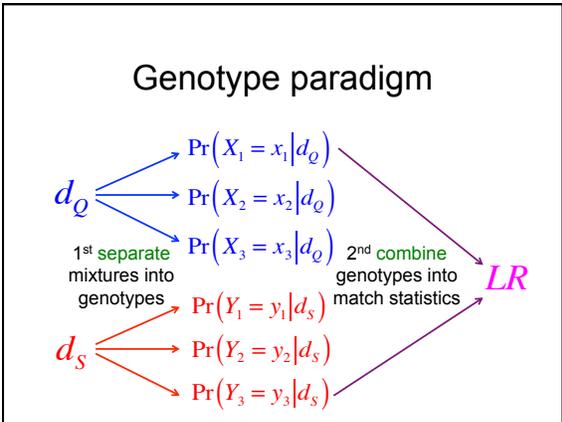


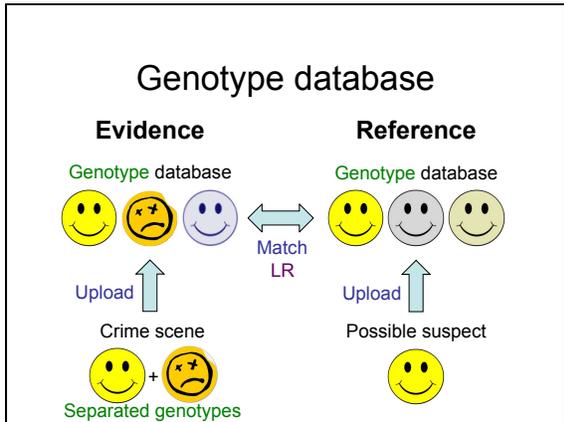


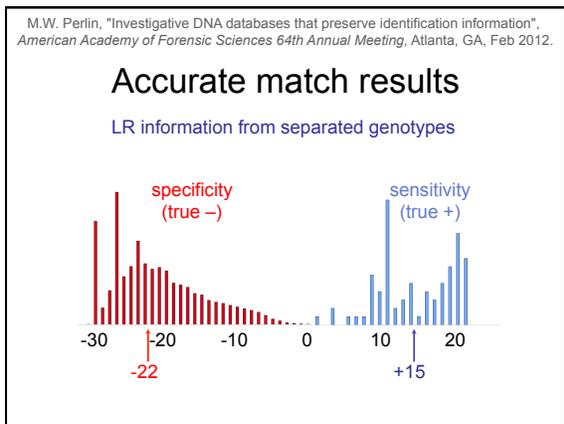
Genotype combination

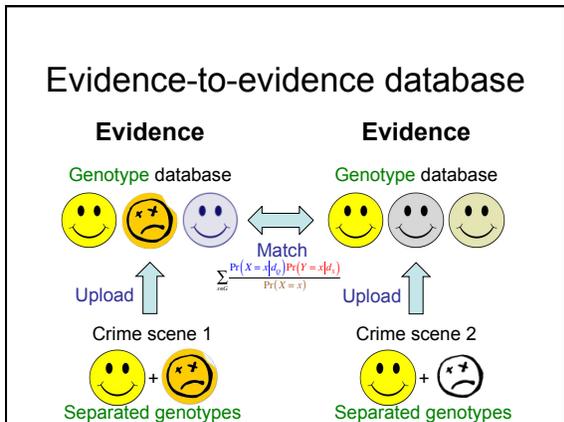
likelihood ratio gives match information

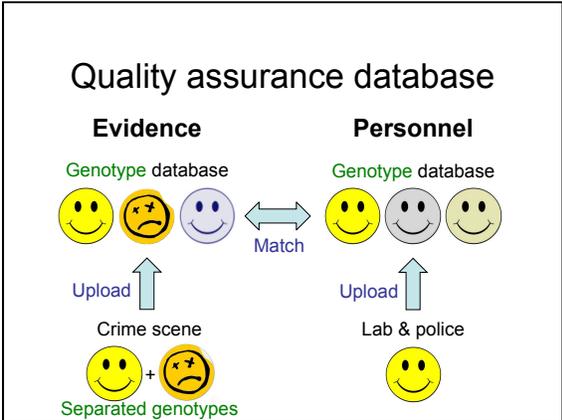
$$LR = \sum_{x \in G} \frac{\text{posterior Q } \Pr(X = x | d_Q) \text{ posterior S } \Pr(Y = x | d_S)}{\text{prior } \Pr(X = x)}$$













DNA rape kit report

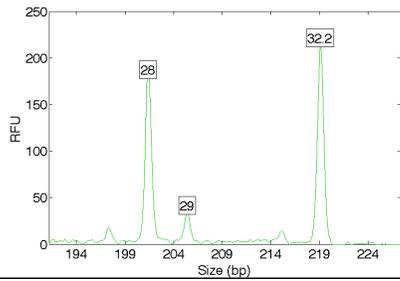
A trace amount of semen detected on vaginal swabs was submitted for DNA profiling

The DNA profile contained limited information. A speculative search was done of the National DNA Database. The search found 13 profiles, 1 in the Hampshire area.

Due to the low level and incomplete nature of the DNA profile, it is not suitable for routine statistical evaluation.

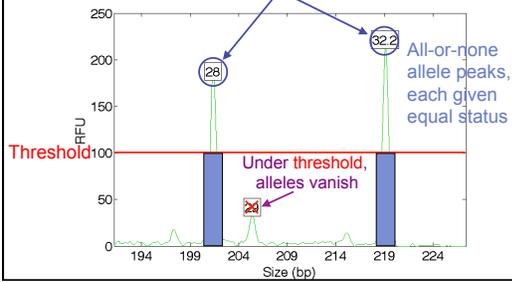
Proper modeling uses all the data

Quantitative peak heights at locus D21S11



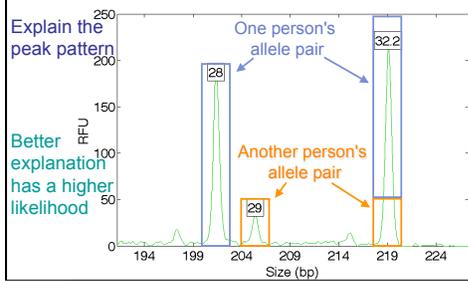
Alternatives use less of the data

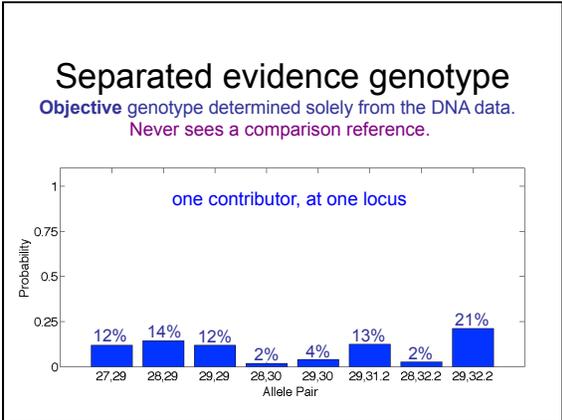
Over threshold, peaks are labeled as allele events

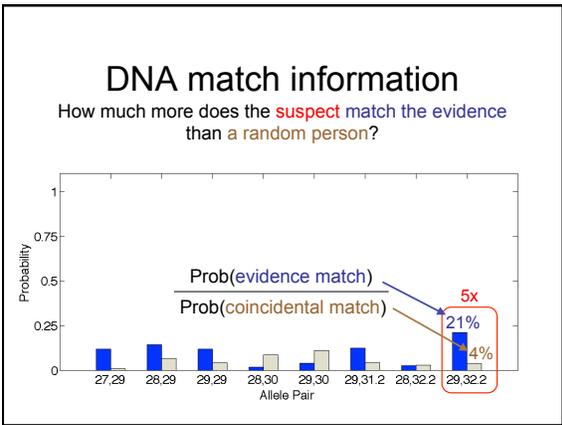


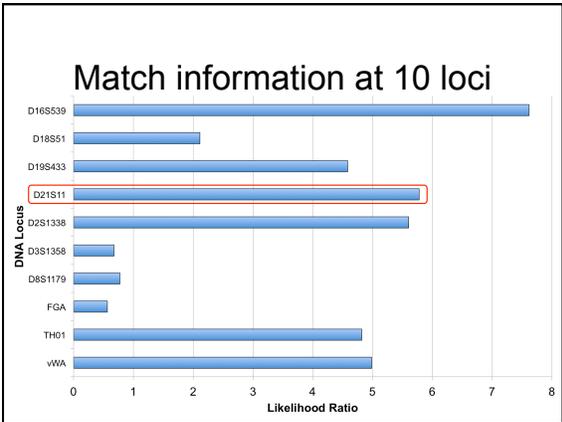
How the computer thinks

Consider every possible genotype solution







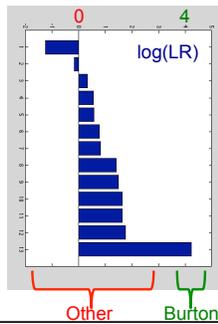


Is the suspect in the evidence?

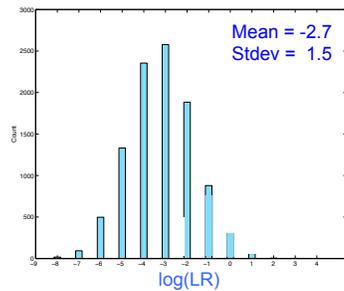
A match between the vaginal swabs
and **Stuart Ashley Burton** is
17 thousand times more probable than coincidence.



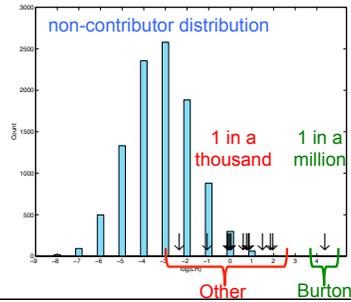
Separating database hits



Non-contributor distribution



Separating hits statistically



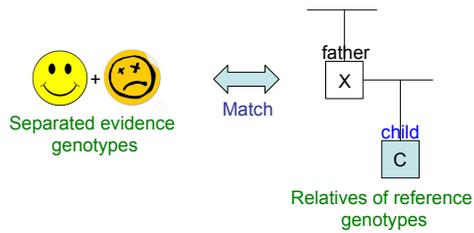
DNA leads to conviction

Mr. Burton pleaded guilty to the rape committed on January 1, 2014. He was sentenced to 12 years in prison.

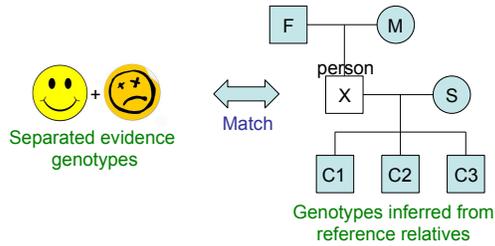


Defendant also convicted of having sex with 13 year old girl

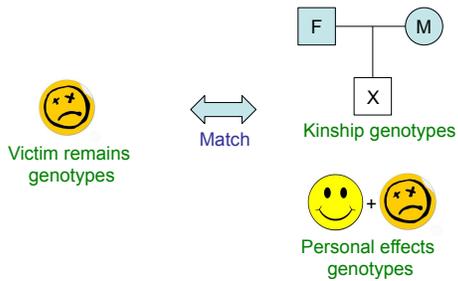
Familial search



Missing persons



Mass disasters



Perlin, M.W. and Miller, K. W. P. Kern County resolves the DNA mixture crisis. Forensic Magazine, 11(4):8-12, 2014.

Database-driven workflow



- Upload plates of EPG data files
- Ask computer batched questions
- Computer gives genotype answers
- Database match directs analysis

Genotype vs allele database

Attribute	Genotype	Allele
Mixtures	separated	thresholds
Upload	100%	10%
Records	probability	list
Compares	genotypes	data
Comparison	likelihood ratio	inclusion
Information	preserves	discards
Output	matches	leads
Genetic loci	few	many (\$)
False hits	few	many (\$)
Missed hits	few	many (\$)

How TrueAllele Works

Part 1, 16-Oct-2014
Genotype modeling and the likelihood ratio

Part 2, 20-Nov-2014
Degraded DNA and allele dropout

Part 3, 18-Dec-2014
Kinship, paternity and missing persons

Part 4, 14-Jan-2015
Genotype database and DNA investigation

<http://www.cybgen.com/information/webinar/page.shtml>



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