

DNA Identification: TrueAllele® Testimony

Mark W Perlin, PhD, MD, PhD
Cybergenetics, Pittsburgh, PA

Continuing Legal Education
Duquesne University
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Cybergenetics

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Interpretation: Same Principle

DNA data

A. Infer genotype

1. Data
2. Model
3. Compare
4. Probability

B. Match genotype
Likelihood ratio

Different Methods

Data Used	<u>inclusion</u>	<u>subtraction</u>	<u>addition</u>
victim profile	NO	YES	YES
original data	NO	NO	YES

Frye: General Acceptance in the Relevant Community

- Quantitative STR Peak Information
- Genotype Probability Distributions
- Computer Interpretation of STR Data
- Statistical Modeling and Computation
- Likelihood Ratio Literature
- Mixture Interpretation Admissibility
- Computer Systems for Quantitative DNA Mixture Deconvolution
- TrueAllele Casework Publications

Validating Mixture Methods

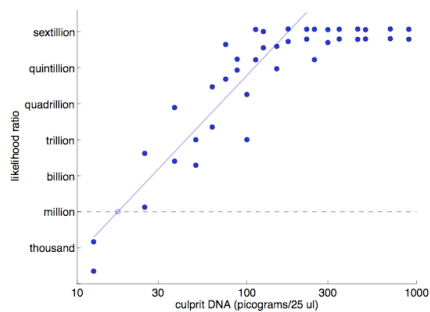
Match Score = Information

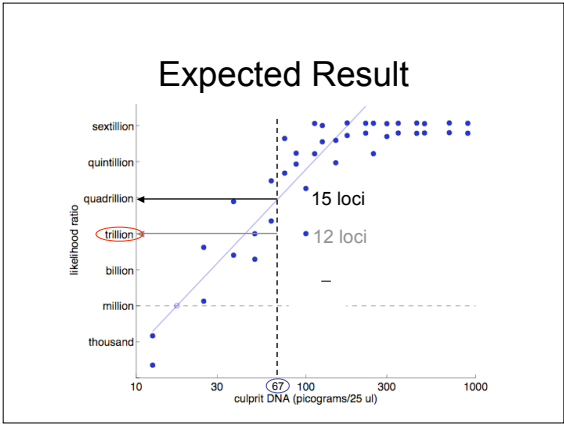
- efficacy
- reproducibility

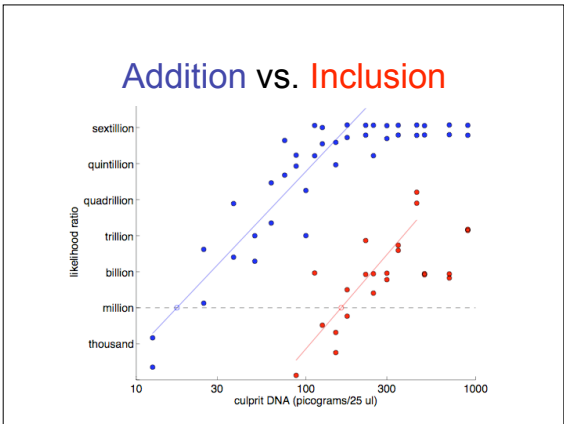
Perlin MW. *Scientific validation of mixture interpretation methods.* Promega's Seventeenth International Symposium on Human Identification, Nashville, TN. 2006.

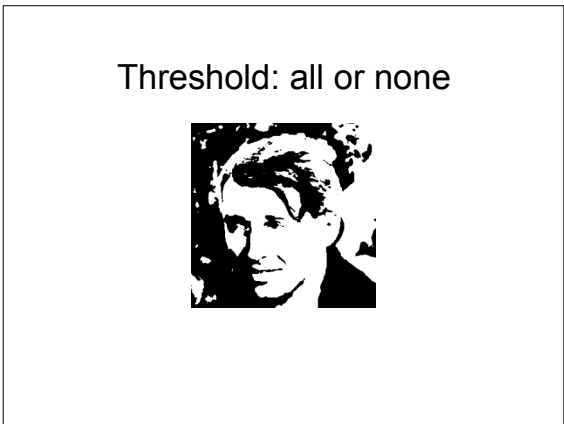
Ranking:
1 Addition
2 Subtraction
3 Inclusion

Validation Study









Continuous: shades of gray



Statistical Inference View

inclusion vs. likelihood ratio

"often robs the items of any probative value" - B. Weir

"usually discards a lot of information compared to the correct likelihood ratio approach" - C. Brenner

"does not use as much of the information included in the data as the LR approach but, conceptually, they are equivalent" - M. Krawczak

"Recommendation 1: The likelihood ratio is the preferred approach to mixture interpretation." - DNA commission of the International Society of Forensic Genetics

Relevant Scientific Community

- The forensic scientists who largely focus on DNA inference and statistics.
- Develop, discuss, publish, validate & assess DNA interpretation methods.
- Implement methods in computer software.
- Provide a pallet of interpretation methods for the practitioner to choose from.
- Lay the scientific foundation for practitioners.
- Give expert backup in court testimony.

Pennsylvania State Police

Mixtures with a known contributor

- genetic profile of the unknown can be inferred
- subtracting the contribution of the known donor
- peak height ratios can be used

Christine S. Tomsey, et al
Forensic DNA Laboratory
Croatian Medical Journal, 2001

Interpretation Differs

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

Some Differences in Reporting Statistics

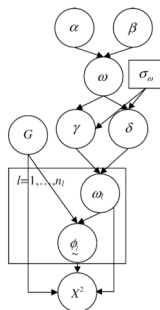
LabID	Kits Used	Cases		
		Caucasians	Afr.	Hispanics
30	ProPlus/Collier	1.18E+15	2.13E+14	3.09E+15
34	ProPlus/Collier	2.80E+11	7.66E+09	3.93E+10
33	ProPlus/Collier	2.94E+08	1.12E+08	1.74E+09
6	ProPlus/Collier	40,000,000	3,500,000	260,000,000
9	ProPlus/Collier	1.14E+07	1.97E+07	1.54E+08
79	ProPlus/Collier	930,000	47,000	1,350,000
16	ProPlus/Collier	434,000	31,710	999,100

Remember that these labs are interpreting the same MIX05 electropherograms

213 trillion (14)

31 thousand (4)

Other Methods are Similar



James Curran.
"A MCMC method for resolving two person mixtures."
Science & Justice.
2008;48(4):168-77.

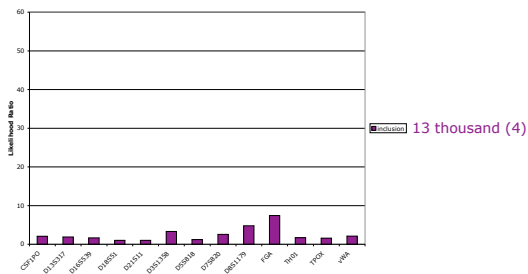
TrueAllele Users

Allegheny County Crime Lab (Forensic Identification)
 Armed Forces DNA Identification Laboratory (Forensic Identification)
 DeCode Genetics, Iceland (Genetic Discovery)
 Forensic Science Service, UK (Forensic Identification)
 Maryland State Police (Forensic Identification)
 Marshall University, WV (Forensic Research)
 Massachusetts State Police (Forensic Identification)
 National Institutes of Health (Genetic Discovery)
 New York City OCME (Mass Disaster Forensic Identification)
 New York State Police (Forensic Identification)
 Orchid Cellmark - Abingdon, UK (Forensic Identification)
 Orchid Cellmark - Nashville, USA (Forensic Identification)
 Puerto Rico Forensic Science Center (Forensic Identification)
 SmithKline Beecham Pharmaceuticals, UK (Genetic Discovery)
 University of Pittsburgh (Genetic Counseling, Genetic Discovery)

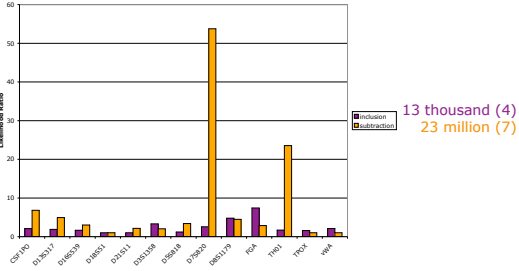
Other Mixture Systems

GeneMapper® ID-X (Applied Biosystems, California)
 FSS I-3® I-STReam (Forensic Science Service, United Kingdom)
 TrueAllele® Casework System (Cybergenetics, Pennsylvania)
 Least Square Deconvolution (University of Tennessee)
 MAIES (Universities of Oxford and Rome, Cass Business School, London)
 MCMC-Pendulum (University of Auckland, New Zealand)

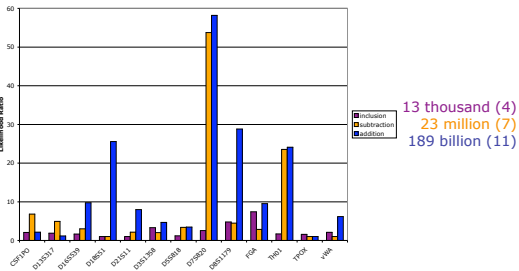
Inclusion DNA Match



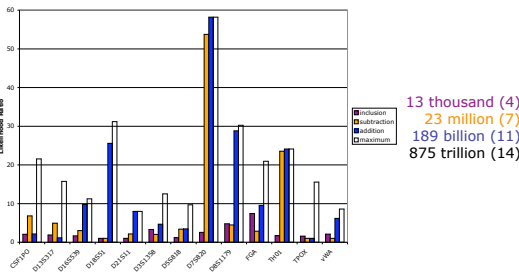
Subtraction DNA Match



Addition DNA Match



Perfect DNA Match



Cross Examination

- How can reliable DNA give different statistics?
- Why doesn't the computer use thresholds?
- Has this method ever been used before in court?

TrueAllele Admitted

COMMONWEALTH OF PENNSYLVANIA
vs
KEVIN J. FOLEY,
Defendant.

IN THE COURT OF COMMON PLEAS
INDIANA COUNTY, PENNSYLVANIA
NO. 1178 CRIM 2007

ORDER OF COURT

MARTIN, P.J.
AND NOW, this 2nd day of March 2009, this matter having come before the Court on the Defendant's Motion to Limit seeking to exclude the testimony of Dr. Robin Cotton and Dr. Mark Peritz and the Court having held a hearing thereon, it is hereby ORDERED and DIRECTED that the Motion to Limit is Denied.

BY THE COURT,



Trial Testimony

- *one principle*: infer genotype, then match
- methods make *different use* of the data
- better data use gives *more information*
- MIX05: *huge variation* in interpretation
- validation study *predicts* match result

Trial Cross Examination

- **Why are there different statistics?**
how method uses data, ethnic population, ...
- **Shouldn't the same data give the same answer?**
microscope analogy for examining same slide
- **Don't computers need thresholds?**
that is a human limitation, and is not relevant

The screenshot shows the Indiana Gazette.com website interface. At the top, the logo reads "Indiana Gazette.com" with "Indiana, Pennsylvania" and "IN PRINT DAILY. ONLINE ALWAYS." below it. A search bar contains "08/17/09" and "41 RESULTS". A navigation menu includes "HOME", "SUBSCRIBERS", "MARKETPLACE", "NEWS", "OBITUARIES", "SPORTS", "BUSINESS", "MULTIMEDIA", and "FYI JOURNALS". Below the menu, there are links for "ARCHIVES > NEWS", "Print", "Email", "Comments (No comments posted.)", "RSS Feeds", and "Text Size". The main article title is "Jury convicts trooper of dentist slaying", published on Thursday, March 19, 2009 at 12:46 AM EDT. The article text states: "An Indiana County Court jury this evening convicted state trooper Kevin Foley of first degree murder in the April 13, 2006, slashing death of Blairsville dentist John Yelenic." A quote follows: "John Yelenic provided the most eloquent and poignant evidence in this case," said the prosecutor, senior deputy attorney general Anthony Krastek. "He managed to reach out and scratch his assailant," capturing the murderer's DNA under his fingernails. At the bottom, a link is provided: www.cybgen.com/information/newsletters/CybgenNews1.pdf
