

# The Triumph and Tragedy of DNA Evidence

Friendship Village  
May, 2017  
Pittsburgh, PA

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



Cybergenetics

Cybergenetics © 2003-2017

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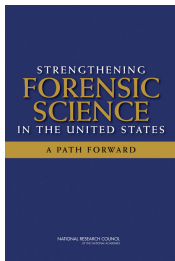
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## National Academy of Sciences



Trouble in River  
City  
2009

Where's the  
"science" in  
Forensic Science?

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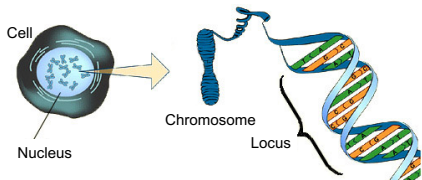
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## DNA biology



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## Short tandem repeat

DNA locus paragraph



23 volumes in cell's DNA encyclopedia

Take me out to the ball game  
take me out with the crowd  
buy me some peanuts and Cracker Jack  
I don't care if I never get back  
let me  
root root root root root root root root root  
for the home team,  
if they don't win, it's a shame for it's one, two,  
three strikes, you're out  
at the old ball game

"root" repeated 10 times, so allele length is 10 repeats

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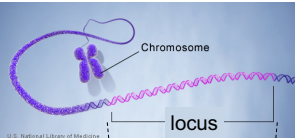
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## DNA genotype



Chromosome  
locus

mother allele  
1 2 3 4 5 6 7 8 9 10  
ACGT repeated word

father allele  
1 2 3 4 5 6 7 8 9 10 11 12

A genetic locus has two DNA sentences, one from each parent.  
An allele is the number of repeated words.  
A genotype at a locus is a pair of alleles.  
10, 12  
Many alleles allow for many many allele pairs.  
A person's genotype is relatively unique.

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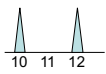
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## Simple DNA interpretation

Evidence item  $\xrightarrow{\text{Lab}}$  Evidence data  $\xrightarrow{\text{Infer}}$  Evidence genotype

DNA from one person



10 11 12

10, 12

Compare

Known genotype

10, 12

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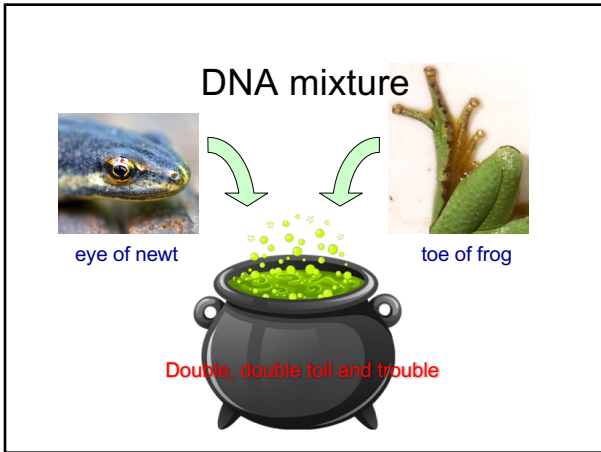
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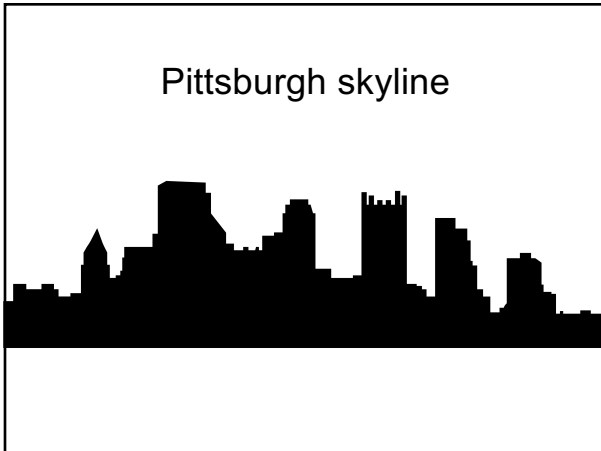
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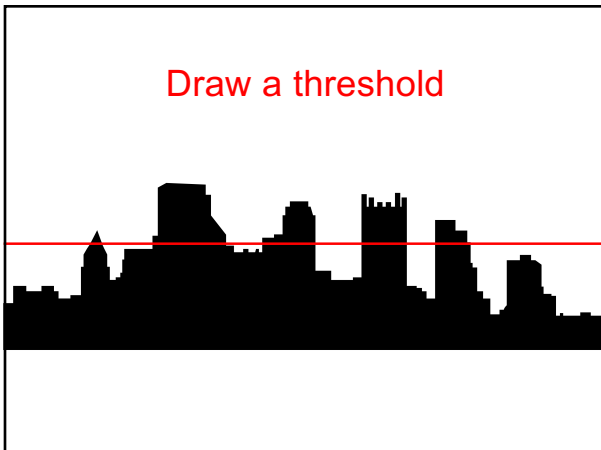
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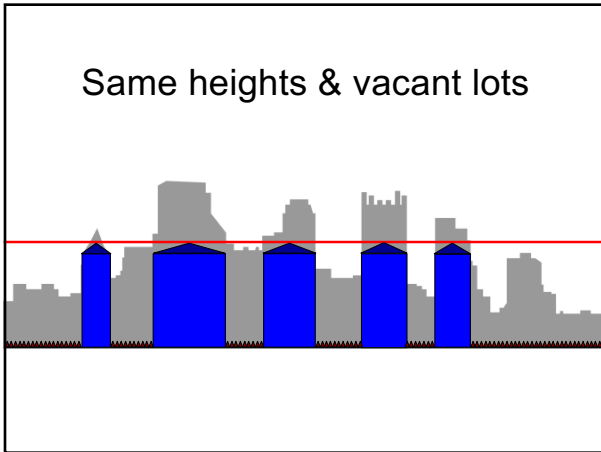
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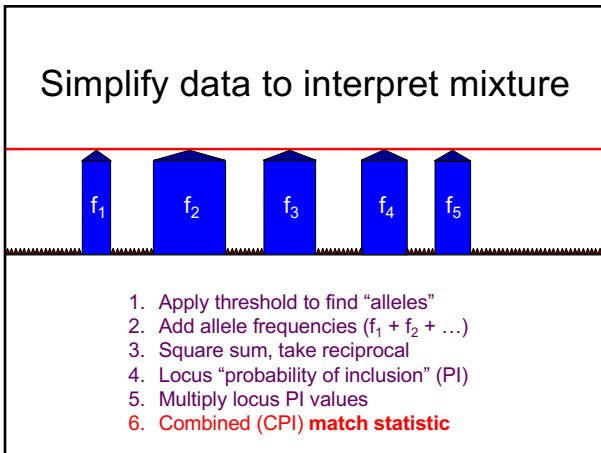
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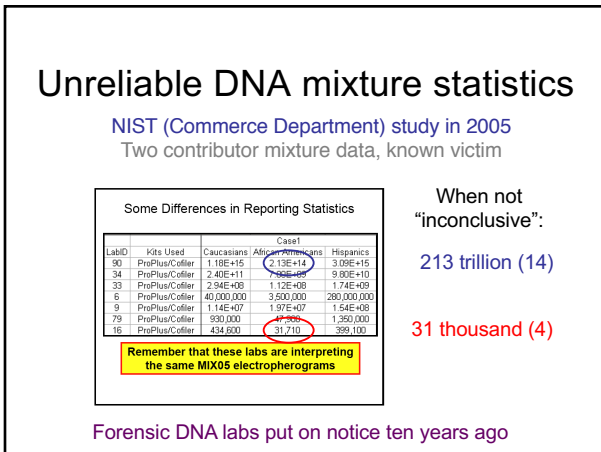
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## Biased DNA workflow


(1)  
Choose data




(3)  
Person decides




(2)  
Calculate statistic





- Put people in the process
- To overcome software limits
- And introduce human bias



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## Falsely identify innocent people

**MIX13 Case 5 Outcomes with Suspect C**  
(whose genotypes were not present in the mixture)

# Labs	Report Conclusions	Reasons given
<b>6</b>	<b>Exclude</b> Suspect C	detailed genotype checks (ID+); TrueAllele negative LR (ID+); assumed major/minor and suspects did not fit (ID+); 3 labs noted Penta E missing allele 15 (PP16HS)
3	Inconclusive with C only (A & B included)	All these labs used PP16HS
21	Inconclusive for A, B, and C	
<b>70</b>	<b>Include &amp; provide</b> <b>CPI statistics</b>	All over the road...

Range of CPI stats for Caucasian population:  
FBI allele frequencies: **1 in 9** to **1 in 344,000**

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## Mixture statistics shut down labs

“National accreditation board suspends all  
DNA testing at D.C. crime lab”  
*The Washington Post* April 27, 2015  
 Did not comply with FBI standards

“New protocol leads to reviews of  
‘mixed DNA’ evidence”  
*The Texas Tribune* September 12, 2015  
 24,468 lab tests affected

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# Statistics lack scientific basis

Misled courts for 15 years on countless DNA mixtures

**J Pathol Inform**

Editor-in-Chief  
Audi K. Parnell, Pittsburgh, PA, USA  
For entire Editorial Board visit: [www.pathinformatics.org/ethicsboard.asp](http://www.pathinformatics.org/ethicsboard.asp)

OPEN ACCESS  
HTML format

Research Article

**Inclusion probability for DNA mixtures is a subjective one-sided match statistic unrelated to identification information**

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E-mail: \*Dr. Mark William Perlin - [perlin@cygn.com](mailto:perlin@cygn.com)  
\*Corresponding author

Received 18 July 2015 Accepted 21 September 2015 Published 28 October 2015

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# TrueAllele<sup>®</sup> computer technology

- Accurate. 34 validation studies, 7 published
- Objective. Workflow removes human bias
- Accepted. Reported in 37 states, used by labs
- Transparent. Give math, software (4GB DVD)
- Neutral. Can statistically include or exclude

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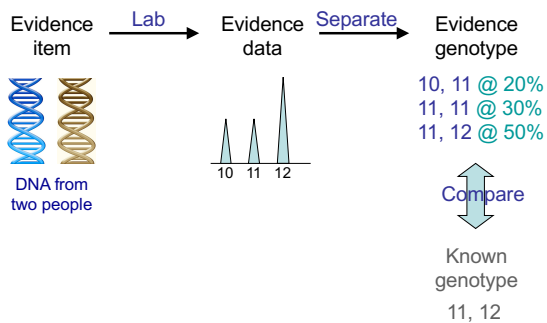
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# DNA mixture interpretation



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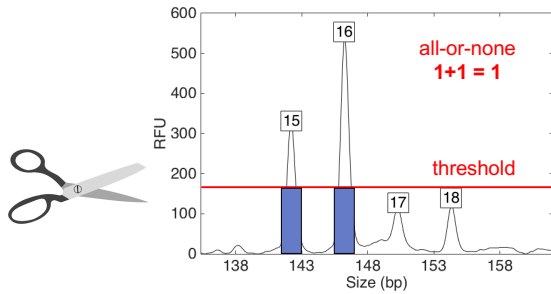
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## Crime labs don't use all DNA data



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## Wolfe sisters homicide



On February 6, 2014, Susan Wolfe (44) and her younger sister Sarah (38, left) were killed in their East Liberty home in Pittsburgh.

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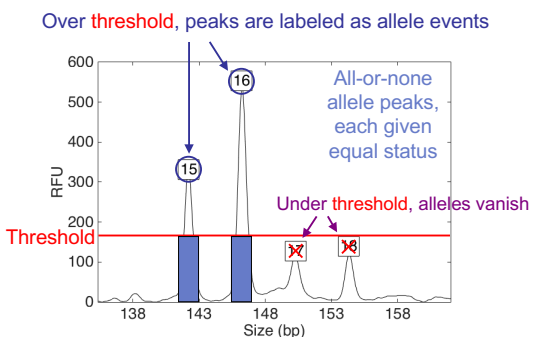
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## Crime lab didn't use all DNA data



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## Pennsylvania v. Allen Wade

Thresholds failed to interpret most DNA mixtures

Hat	No conclusions
Cup	Insufficient data
Fingernails	Contamination, insufficient data
Gear shift	Insufficient data
Seat lever	Cannot be excluded
Knit hat	Insufficient data
Sock	Too complex, no conclusions

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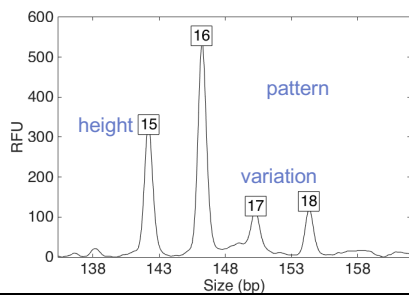
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## Computers can use all the data

Quantitative peaks at locus vWA




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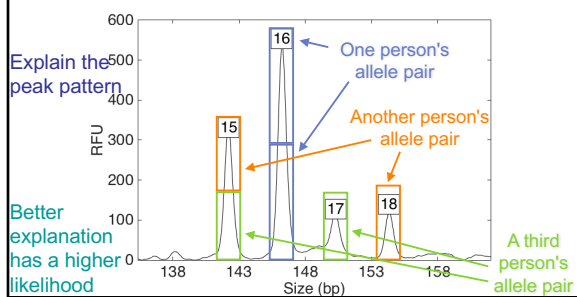
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## How the computer thinks

Consider every possible genotype solution




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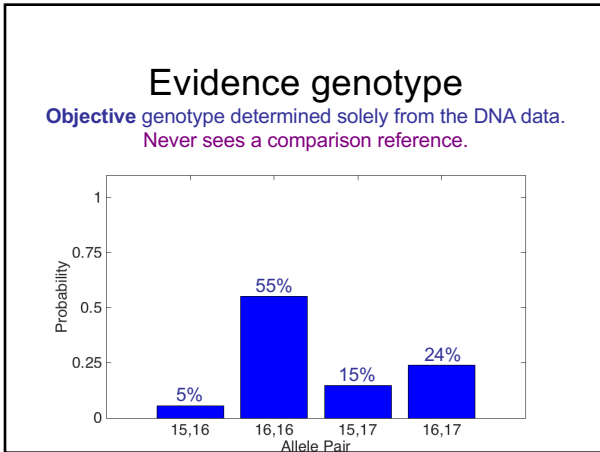
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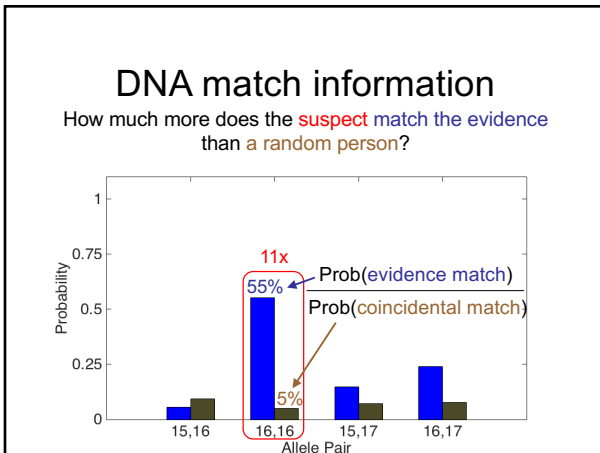
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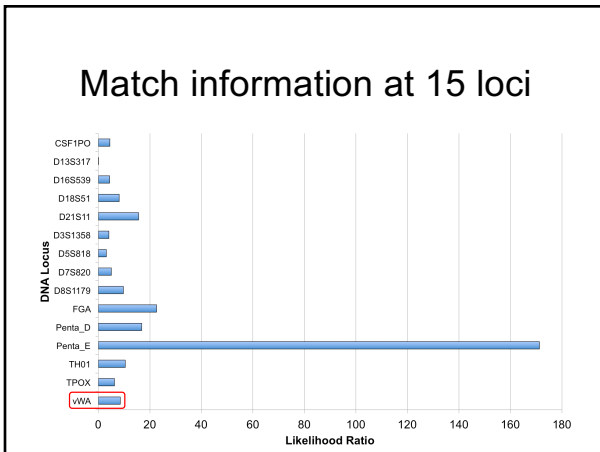
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## Is the suspect in the evidence?

A match between the right fingernails and Allen Wade is:

6.06 trillion times more probable than a coincidental match to an unrelated Black person

32.5 trillion times more probable than a coincidental match to an unrelated Caucasian person

8 trillion times more probable than a coincidental match to an unrelated Hispanic person

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## Pennsylvania v. Allen Wade

The crime lab reported 5 DNA mixture matches  
TrueAllele found 17 matches on the same data

Hat	65.3 thousand	Allen Wade
Cup	20.5 thousand	Susan Wolfe
Fingernails	6.06 trillion	Allen Wade
Gear shift	9.37 million	Sarah Wolfe
Seat lever	385 billion	Sarah Wolfe
Knit hat	25.7 thousand	Allen Wade
Sock	300	Sarah Wolfe

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## Allen Wade Found Guilty On All Counts In East Liberty Sisters' Slaying

CBS News, May 23, 2016

PITTSBURGH (KDKA/AP)

- A man accused of killing two sisters who lived next door to him in East Liberty has been found guilty on all counts.
- Allen Wade was accused of shooting Sarah and Susan Wolfe after they returned from work on Feb. 6, 2014, apparently to steal a bank card.
- On Monday morning, a jury found Wade guilty of first-degree murder, robbery, burglary and theft by unlawful taking.

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## Pennsylvania v. Allen Wade

Thresholds failed to interpret DNA mixture  
TrueAllele succeeded on the same data

A hat left from a burglary of the Wolfe sister's home  
six weeks before the murder matched  
Allen Wade with a 65.3 thousand statistic



Preventable Crime

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## No information from mixture

Crime laboratory DNA report  
Crime lab user fee: \$5,000

### Conclusions:

#### Item 1 – Swab of textured areas from a handgun

The data indicates that DNA from four (4) or more contributors was obtained from the swab of the handgun. Due to the complexity of the data, no conclusions can be made regarding persons A and B as possible contributors to this mixture.

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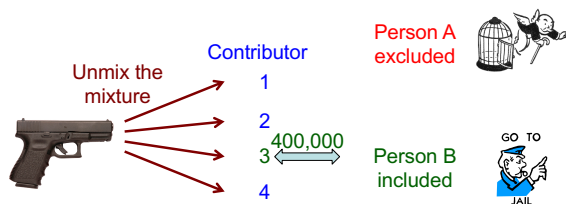
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## Computer reanalysis

Cybergenetics TrueAllele report  
Match statistic provides information



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Allegheny County: 59 cases, 13 trials, 3 exonerations

Crime	Evidence	Defendant	Outcome	Sentence
rape	clothing	Ralph Skurdnich	guilty	75 years
murder	gun, hat	Leland Davis	guilty	23 years
rape	clothing	Akaninyene Akan	guilty	32 years
murder	shotgun shells	James Yeckel, Jr.	guilty plea	25 years
murder	fingernail	Anthony Morgan	guilty	life
weapons	gun	Thomas Doswell	guilty plea	1 year
bank robbery	clothing	Jesse Lumberger	guilty	10 years
drugs	gun	Derek McKissick	guilty plea	2 1/2 years
drugs	gun	Steve Morgan	guilty plea	2 1/2 years
murder	door, clothing	Calvin Kane	guilty plea	20 years
murder	fingernail, clothing	Allen Wade	guilty	life
murder	gun	Jaykwaan Pinckney	guilty plea	10 years
child rape	clothing	Dhaque Jones	guilty plea	6 years
shooting	gun	Anthony Jefferson	guilty plea	4 years
weapons	gun	Zachary Blair	guilty plea	15 years
weapons	gun	Delmingo Williams	guilty plea	3 years
incest rape	clothing	Terry L.	guilty	40 years
bank robbery	hat	Robert Schatzman	guilty	1 1/2 years
weapons	gun	Rashawn Walker	guilty	1.5 years
robbery	hat	Lauren Peak	guilty plea	1 year
rape	body cavity	Freddie Cole	guilty plea	2 years
murder	gun	Chaz White	guilty plea	4 years
sex crime	clothing	Christopher Stavish	guilty plea	2 1/2 years
murder	gun	Jake Knight	guilty	life

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## Countywide DNA database

### Pittsburgh Post-Gazette

Allegheny County crime lab vying to use more advanced DNA database

Technology developed by Cybergenetics gets conclusive results from DNA mixtures

February 28, 2014

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## Darryl Pinkins imprisoned

1989 – 5 men raped an Indiana woman  
Darryl Pinkins and 2 others misidentified  
1991 – wrongfully convicted, 65 year sentence

2001 – DNA mixture evidence  
2 contributors found, not the accused  
but 5 were needed, post-conviction relief denied

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## TrueAllele Pinkins findings

1. compared *evidence with evidence*
2. calculated *exclusionary match statistics*
3. revealed *5% minor mixture contributor*
4. *jointly analyzed DNA mixture data*
5. showed three perpetrators were *brothers*

found 5 unidentified genotypes,  
defendants not linked to the crime

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## Pinkins exonerated



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## Why crime labs fail on mixtures

- Expertise in forensic biology
  - Great at generating DNA data
- Not in computational statistics
  - Poor at interpreting the data
- Adversarial nature of court
  - Cross-examination, termination
- Strong incentives on lab process
  - Focus on data, not information
- Fear of uncertainty, comfort in certainty
  - Saying nothing avoids controversy

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## Recommendations

1. Open DNA to public scrutiny
2. Revisit all past DNA mixture cases
3. Educate trial attorneys and judges
4. Fully automate mixture interpretation
5. Extensively validate DNA interpretation
6. Keep methods within their limits
7. Go beyond laboratory limits

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## Non-governmental organization



JUSTICE  
THROUGH  
SCIENCE

1. Reanalyze forgotten DNA evidence
2. Educate lawyers, scientists & society

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## More information

<http://www.cybgen.com/information>



- Courses
- Newsletters
- Newsroom
- Presentations
- Publications
- Webinars

<http://www.youtube.com/user/TrueAllele>  
TrueAllele YouTube channel



Cybergenetics



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